

CLEARING UP THE SMOKE:

Untapping the
Potential of
Tailored Clean
Cooking Programs
in Latin America

**Cataloging-in-Publication data provided by the
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Felipe Herrera Library**

Clearing up the smoke: untapping the potential of tailored clean cooking programs in Latin America /
Pauline Ravillard, Enrique Chueca Montuenga, David López Soto, Alberto Levy, Mauricio Tolmasquim, Iván
Logrosan, Álvaro Cano, Michelle Hallack.

p. cm. — (IDB Monograph ; 856)

Includes bibliographic references.

1. Stoves, Wood-Environmental aspects-Guatemala. 2. Stoves, Wood-Environmental aspects-Ecuador.
3. Stoves, Wood-Environmental aspects-Peru. 4. Indoor air pollution-Guatemala. 5. Indoor air pollu-
tion-Ecuador. 6. Indoor air pollution-Peru. I. Ravillard, Pauline. II. Chueca Montuenga, Enrique. III. López
Soto, David. IV. Levy, Alberto. V. Tolmasquim, Mauricio Tiomno. VI. Logrosan, Iván. VII. Cano, Álvaro.
VIII. Hallack, Michelle, 1983- IX. Inter-American Development Bank. Energy Division. X. Series.

IDB-MG-856

JEL Codes: O13, O54, N76, Q53, Q54, Q42, Q48, I15

Keywords: Clean cooking programs, efficient technologies, health, air pollution, energy, Latin America

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CLEARING UP THE SMOKE: UNTAPPING THE POTENTIAL OF TAILORED CLEAN COOKING PROGRAMS IN LATIN AMERICA ¹

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WASHINGTON DC, OCTOBER 2020

1. The authors thank the anonymous reviewers for their comments and suggestions. We would also like to thank Alejandro Paramo Rojas and Maria Eugenia Sanin for their suggestions and comments, as well as Zoe Bienvenu, Victor Ruiz Garcia and the NGOs Puente and Buenos Vecinos for their support in the implementation of the fieldwork in Guatemala.



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1. INTRODUCTION

One of the biggest energy challenges we face today is the reduction of black carbon production. Examples of initiatives to lower black carbon² by 80% before 2050 are modernizing cooking and heating stoves, improving diesel vehicle standards, adding diesel particulate filters on vehicles, removing vehicles with high emissions from circulation, and restricting the burning of agricultural open field, amongst others (UNEP, 2018).

Latin American and the Caribbean (henceforth LAC) is one of the regions in the world where action is essential, as health is severely affected by these black carbon emissions. Indeed, out of 4.3 million deaths in the world from the use of solid fuels for either cooking or heating – including health issues and accidents – in 2012, about a fifth alone were in LAC (WHO, 2014). If by 2050 no action is taken to improve air quality, annual premature mortality from PM2.5 is expected to be multiplied by almost two (UNEP, 2018).

One of the major sources of air pollution in LAC, after transport and industry, comes from residential cooking and heating. The use of fuel wood is particularly harmful and present mostly in rural and periurban areas, especially in Central American countries. In fact, the consumption of biomass, in the form of charcoal, dung, agricultural waste or firewood, is still high in urban areas in Haiti, Guatemala, Nicaragua, Honduras, Paraguay and Peru (WHO, 2015). As of 2017, about 90 million people in LAC still relied on solid fuels for cooking, which is about 15% of the total population (Troncoso and Soares da Silva, 2017).

Several studies have found that both in terms of costs and impacts, transitioning to ‘clean’ kitchens (i.e. kitchens with no open fire pits where biomass is being burnt), is an effective and profitable solution for indoor pollution problems, as they improve combustion and generate lower levels of carbon emissions, amongst other benefits (Levy, 2020). This transition can also bring out positive results on deforestation, which is one of the consequences of using wood as a fuel to cook (Rosenthal, 2018; Sanin, 2019). However, whereas efficient cookstoves are a significant improvement, they still impact health. According to air quality guidelines by the World Health Organization³ (WHO), the maximum acceptable concentration of health-harmful particulates are still exceeded by efficient cookstoves (Johnson and Chiang, 2015). Only the use of clean fuels, such as electricity or gas, can help respect this threshold (Rosenthal et al., 2018).

2. Black carbon is “a potent climate-warming component of particulate matter formed by the incomplete combustion of fossil fuels, wood and other fuels (...). A complete combustion would turn all carbon in the fuel into carbon dioxide (CO₂), but combustion is never complete and CO₂, carbon monoxide, volatile organic compounds, and organic carbon and black carbon particles are all formed in the process” (CCAC, 2020). An efficient combustion minimizing black carbon, however, should be pursued for environmental, health and economic reasons.

3. <https://www.who.int/airpollution/guidelines/household-fuel-combustion/en/>

These particulates emitted from cooking with ‘dirty’ fuels are also known to have considerable health impacts, such as reduced birth weight, high blood pressure, acute lower respiratory infections, chronic obstructive pulmonary disease and asthma (for a review of studies see Puzzolo et al., 2013). This method of cooking and heating is also associated with safety issues inside the households, such as increasing the risk of household accident from fire (Ibid.). Because of its harmful health effects and increased household accidents, as well as air pollution more generally, adopting policies directed at transitioning from “dirty” to “clean” cooking and heating stoves is essential in LAC.

Transitioning from traditional⁴ to improved kitchens also has several other advantages, on top of countering air pollution or household accidents and improving health conditions. It can also act as a generator of rural income and women empowerment (Rosenthal, 2018). Depending on the technology replacement (i.e. from traditional wood to improved wood kitchens, from fuel wood to gas, or directly to an electrical kitchen, or from gas to electricity), cooking time can be saved, and can be spent in different ways, including working, therefore generating supplementary income.

Another advantage of the transition is that it may also reduce household spending on fuel, which would lead to real savings. On average, 70% of households interviewed by the Inter-American Development Bank (henceforth IDB) in a survey carried out in 2019 reported to be buying wood (Levy, 2020). They also reported that spending in firewood for cooking represented 9% of their monthly household income.

Improving cooking technologies in LAC’s households is necessary and needs to be done immediately. In this context, well-designed policies, programs and their implementation are essential. This monograph provides policy-makers with key elements aimed at improving clean cooking strategies. These are based on: (1) an analysis of previous experiences in LAC; (2) identifying the characteristics of the population targeted; (3) estimating the potential impact of clean cooking policies; (4) identifying the policies’ barriers and (5) making policy recommendations.

Throughout this document, we focus on three case studies. These are Guatemala, Peru and Ecuador. The reason for this selection is manifold. First, they represent very different cases with their own characteristics of the programs and transition phases. Second, we have complete household survey datasets that include our variables of interest for the empirical analysis of these three countries. These surveys were harmonized, allowing for consistent comparison of results for different countries. Finally, these are also countries where information on clean cooking programs is available and accessible. In the case of Guatemala, this was less the case than for Peru and Ecuador, but we were able to take advantage of a fieldwork carried out in February 2020 to gather complementary qualitative information, which has enriched our empirical analysis and supported several of our hypotheses.

This document is organized as follows. First, we detail concepts of clean cooking programs and what has been done in LAC. The meaning of clean cooking and its different transition phases are defined. Then, we compare some of the characteristics of the different programs in the region. In the following section, we identify the adopters of clean cooking programs and who the potential adopters usually are, by reviewing existing studies and relying on econometric methods. We concentrate our analysis on the population with the lowest income, for whom the challenge of access to services is higher. There is considerable heterogeneity within those groups. We develop a broad methodology to identify the characteristics of these groups and of their sub-groups. Our analysis focuses on three countries as case studies: Guatemala, Peru, and Ecuador. However, it could be extended to more countries.

4. In the present work when we talk about traditional kitchens, we mean biomass, usually wood, burnt in open fire.

Next comes a section on the urgency of addressing the lack of clean cooking practices by discussing the effects on health, mostly respiratory, but also other health-related issues, of the use of inadequate technologies. We focus on two countries, Peru and Guatemala; and for the last one present new data collected from a study carried out during fieldwork.

The fourth section focuses on obstacles to the adoption of clean cooking by looking at both pre- and post-adoption barriers. Pre-adoption barriers come before the household installs or starts using the clean cooking stove, whereas post-adoption barriers happen when the household has already started using the clean cooking stoves but does not continue to use it, or at least not constantly, leading to attrition. These barriers are socioeconomic, informational, infrastructural, financial, institutional, cultural and traditional, or community-based, by nature. We argue for the need of tailored programs considering the challenges before the adoption, but especially post-adoption (which is frequently neglected).

In the fifth section, we discuss some policy recommendations that can be drawn from this study, but that can also be integrated within broader knowledge on this topic, to give some sound suggestions for policy-makers. We conclude with some final remarks about what we know, the limits of the study and the need of further studies. In order to ease the document's flow, the details of the methodology, and for the interviews that were carried out during fieldwork in Guatemala can be found in the appendices.



2 WHERE DO WE STAND? THE CONTEXT OF CLEAN COOKING PROGRAMS IN LAC

This section discusses the context of clean cooking in LAC by presenting the different technologies and programs. With respect to technologies, there is a modernization path for clean cooking. Innovation accompanied by decreases in costs create leapfrogging opportunities, such as the adoption of induction cookstoves, that deserve considerable attention.

By comparing the different clean cooking programs across LAC, one can see that they vary in coverage, timing and type of subsidy. We apply this conceptual scheme to two of our three case studies, Ecuador and Peru, in order to illustrate it using real examples and also to set a context for the interpretation of results in section 3. Understanding differences between clean cooking programs in LAC is key. It can nourish the discussion on the importance of taking into account heterogeneity to tailor programs according to needs and specificities of each community.

2.1 What is clean cooking?

In the present study, clean cooking consists of a transition from the use of a cooking stove that pollutes more in terms of CO₂ emissions and particulates, to a cooking stove that pollutes less, therefore making the air around the cooking stove “cleaner”. It is worth mentioning that particulates are the most harmful pollutant with respect to health. Our definition of “clean cooking” here particularly focuses on these particulates in the air that are harmful for health.

There are different types of “clean cooking” transitions. The first one would be from the use of fuel wood with a traditional kitchen to the use of fuel wood with an improved kitchen. In this case the air pollution remains, but it is lower. The second transition is from the use of fuel wood, regardless of the kitchen type, to the use of gas for cooking with the appropriate cooking stoves. The gas in this case is usually liquified petroleum gas, also known as LPG. This transition leads to a considerable reduction of air pollution in terms of particulates that are harmful for health, but continues to generate significant amounts of GHG emissions, nonetheless. Finally, transition to electrical cooking stoves with zero local emissions replacing gas, or fuel wood. Figure 1 below illustrates examples of different transition stages⁵.

5. An additional step here would be the conversion from wood to charcoal for cooking. This has been mostly seen in sub-Saharan Africa, Southeast Asia and, to a lesser extent, South American countries (FAO, 2017). However, this step is not as relevant in our specific case studies and is therefore omitted from Figure 1.

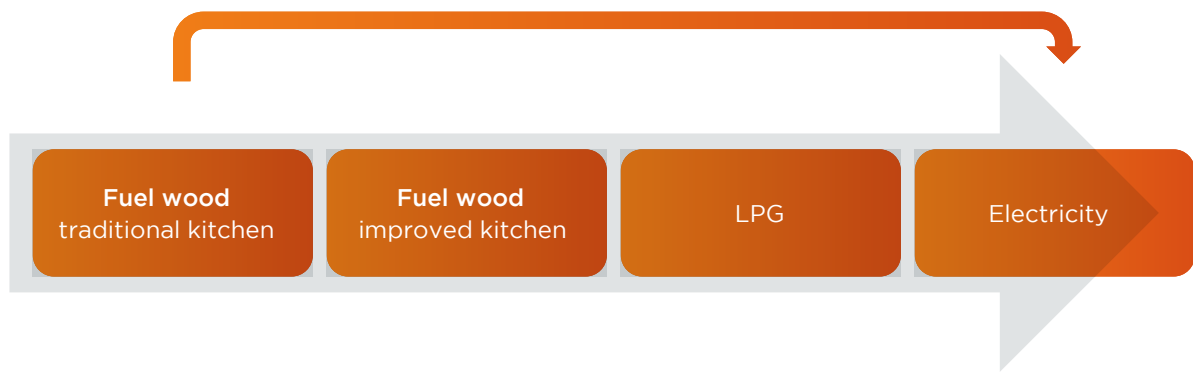


Figure 1. Examples of different “clean cooking” modernization stages

Source: own elaboration

From the fieldwork carried out in rural Guatemala, we noticed that there seems to be three categories of ‘kitchens’: the open pit fire, the non-improved cookstove and the improved cookstove. The two latter can either be built on site or built in a factory. Those built on site could have parts purchased from a local shop, such as the plate or even the whole combustion chamber. The portable cookstoves are usually made in a factory, but local shops could also make them.

The improved cookstove appears to have been built by a manufacturer, or at least that has been properly installed, with a plate most likely bought at a shop or factory. The non-improved cookstove (i.e. built by a household member or a local mason, not a manufacturer) appears to be less efficient in the long-term and in spite of having a chimney, the lack of its maintenance means that it does not manage to get the smoke out of the house. The non-improved cookstove’s impact on health is much worse than that of the improved cookstove, as is reported in Appendix 5 that gives more information on the fieldwork and interviews carried out.

Differentiating between the different stages of the transition and between whether fuel wood is used with a traditional or an improved kitchen, matters in terms of the potential impact on health or on household accidents. In other words, even though transitioning from fuel wood used in a traditional kitchen to fuel wood used in an improved kitchen reduces air pollution, the impact on health is not as evident. In fact, the resulting effects are usually smaller than initially expected in the case of this specific transition within biomass fuel use (Rosenthal, 2018). Similarly, even if biomass fuels used for cooking or heating are renewably harvested, they still produce more air pollutants, compared to LPG combustion (Troncoso and Soares da Silva, 2017). Whereas the impact on health of a transition from fuel wood in an open fire to an non-improved cookstove is minimal due to polluting gases escaping from the chimney or combustion chamber inside the house, the impact on the incidence of household accidents is considerable, as the fire is not in the open air anymore, but rather contained and controlled, thanks to the chimney.

It is worth noting that some transitions are not made fully. This means that despite a transition from one cooking method to another, this does not necessarily imply the end of the previous method. In fact, out of the households that transit from LPG to electricity cooking stoves, rare are those that do not keep their LPG cooking stoves and adopt the electrical stoves exclusively (see Gould et al. 2018b for a case study of Ecuador). This problem is better known as fuel stacking.

The same can be said about households that use improved kitchens with fuelwood but continue to use their open pit fire on the side, as we found in our case study in Guatemala. Indeed, a few households responded that in spite of using the improved kitchen stove regularly, they still used their previous open fire pit, either because the improved kitchen stove was not

big enough to allow all meals to be cooked simultaneously, or to use large pans, or because tortillas, the most common food, was more easily made on the old cooking stove.

Similar findings emerged from an evaluation of the level of information and maintenance of improved kitchens by the EnDev Program in Peru (see Box 2 below). IPSOS (2013c) found that Peruvian households did not stick to one type of cooking method, despite the initial transition. The study noted that a significant proportion of beneficiaries stopped using the improved kitchen permanently, indicating that, in general, after the second year of installation, the frequency of its use is reduced. This is a significant problem in the transition to clean cooking. We return to the post-adoption barriers that can eventually lead to attrition in Section 5.

Still in the Peruvian case, in the context of the FISE program (see Box 1 below for more details about this program), Hollada et al. (2017) identified that, especially in resource-poor settings, exclusive adoption of clean cooking technologies is not common. Along those lines, Calzada & Sanz (2018) show that the FISE program favored the adoption of the LPG cookstoves, but that many households still combined their use with traditional cookstoves.

Table 1 below gives a brief comparison of the benefits between using open fire, an improved cookstove and LPG, which is relevant in our study of Guatemala, as the share of households that cook with electricity is negligible. It is worth mentioning that findings in Table 1 only apply generally and that the list is not exhaustive. For instance, open fire is cheap in terms of the cost of the stove. However, this estimate does not take into account the cost of buying the wood, that can be the case in many countries, such as Guatemala (Levy, 2020).

| Technology | Reasons for using it | Benefits | Problems |
|--------------------|---|---|--|
| Open fire | <ul style="list-style-type: none"> • Is faster • Provides space heating • Supports heavy pots • Accepts large logs • Is customary | <ul style="list-style-type: none"> • Is cheap • Is versatile • Does not require learning new skills | <ul style="list-style-type: none"> • Smoke is a nuisance • Smoke gets the kitchen dirty • Smoke is a health problem • Smoke the food |
| LPG | <ul style="list-style-type: none"> • Is faster • Is easier to use • Is suitable when there is no fuelwood • Is convenient • Does not smoke | <ul style="list-style-type: none"> • Is handy | <ul style="list-style-type: none"> • Is expensive • Is unsuitable to make tortillas. • Does not heat the kitchen |
| Improved cookstove | <ul style="list-style-type: none"> • Does not smoke • Is aesthetic • Saves fuelwood • Is better for health | <ul style="list-style-type: none"> • Saves fuelwood • Recovers the kitchen as a place for family reunion • The user does not get too hot | <ul style="list-style-type: none"> • Its entrance is small • Is difficult to light • Its maintenance is difficult • Needs special fuelwood • Requires learning new skills |

Table 1. Comparison of benefits between cooking technologies
Source: Troncoso et al. (2007)

From Table 1, it can be deducted that the open fire is the most harmful for health, though cheaper if wood collection is free and easy. Both LPG and improved cookstoves are better for health. However, LPG is more expensive, and in case of a poor maintenance of the chimney of an improved cookstove, the problem of emission of particles in the air is not overcome, which then makes it harmful for health. On the contrary, gas does. The improved cookstove requires special fuelwood in the sense that the pieces of firewood needed should be smaller, as is justified also by the smaller entrance, which itself has the role of increasing efficiency.

Whereas the jump from open fire to gas seems more desirable to overcome the negative health impact of burning fuel wood, LPG is more expensive in terms of gas tanks and stove, and requires an easy access to those tanks. This access often depends on appropriate roads for transportation and connection roads for distribution. It also does not overcome the cultural and traditional barriers associated to the change in the taste of food, the repelling of insects, especially mosquitoes, the heating of the surroundings and the easy tortilla making, which have been reportedly associated with open fire cooking in the literature, as reported in section 5 below. We return to these further below when we talk about adoption barriers. Table 9 below presents a rough comparison of the benefits of cooking with wood, LPG and electricity on air pollution, health, and domestic accidents, broadly speaking.

2.2 Clean cooking programs across LAC

In this section, a brief regional overview of clean cooking programs and their concentration in Latin America and the Caribbean (LAC) is given, followed by a suggested conceptual framework to analysis these programs, and later its application to two of our case studies: Ecuador and Peru.

2.2.1 Regional overview

In the region of LAC, clean cooking programs have been particularly present in Central American and Andean countries, regions where the use of fuel wood for cooking is the most common. In 2008, biomass made up for 34% of total final energy consumption in Central America. Guatemala, Honduras and Nicaragua alone represented about 86% of the users of fuel wood in the region (Wang et al., 2013). According to Sanin (2019), these are also the countries with the lowest access to clean fuels and technology for cooking rates in the region in 2016 (after Haiti). Guatemala, more particularly, is the country that reports the highest wood consumption in Central America (Levy and Perez, 2019; Levy, 2018).

Several reasons can explain the concentration of biomass, and more specifically wood, as a fuel for cooking in Central America and the Andes, compared to electrical stoves or LPG. One of them has to do with the fact that these are the regions of LAC with the lowest access to electricity (OLADE, 2018) and also those with lower income levels relative to their neighbors⁶, as per the World Bank's data on GNI per capita⁷.

Still through a regional comparative lens, countries in Central America and the Andes might also be lacking the necessary infrastructure to allow the transport and distribution of alternatives to fuel wood for cooking. By contrast, collecting wood is usually free of monetary cost (though it can be costly in terms of the time spent on collection and have long-term impacts on health if the wood is heavy to carry) and easily accessible, especially for households located in rural areas, which leads to less dependence and reliance on external services⁸.

6. Income as a socio-economic barrier to adoption is further detailed below in Section 5.

7. At current international dollars converted by purchasing power parity conversion factor. Accessible from: <https://data.world-bank.org/indicator/NY.GNP.PCAP.PP.CD?locations=ZJ>

However, it is worth mentioning that some areas will face different situations, especially where deforestation is a real issue, and where informal, though dynamic and structured, wood markets are being created⁹.

Out of the countries that have the highest concentration of solid fuels for cooking and heating, some have shown considerable improvements by reducing this usage, such as Dominican Republic, Ecuador, Peru and El Salvador, thanks to successful transition programs (Troncoso and Soares da Silva, 2017). By contrast, countries like Haiti and Guatemala have not brought the share of biomass fuels down. As Figure 2 shows, they remain the countries in the region with the lowest access to clean fuels and technology for cooking.

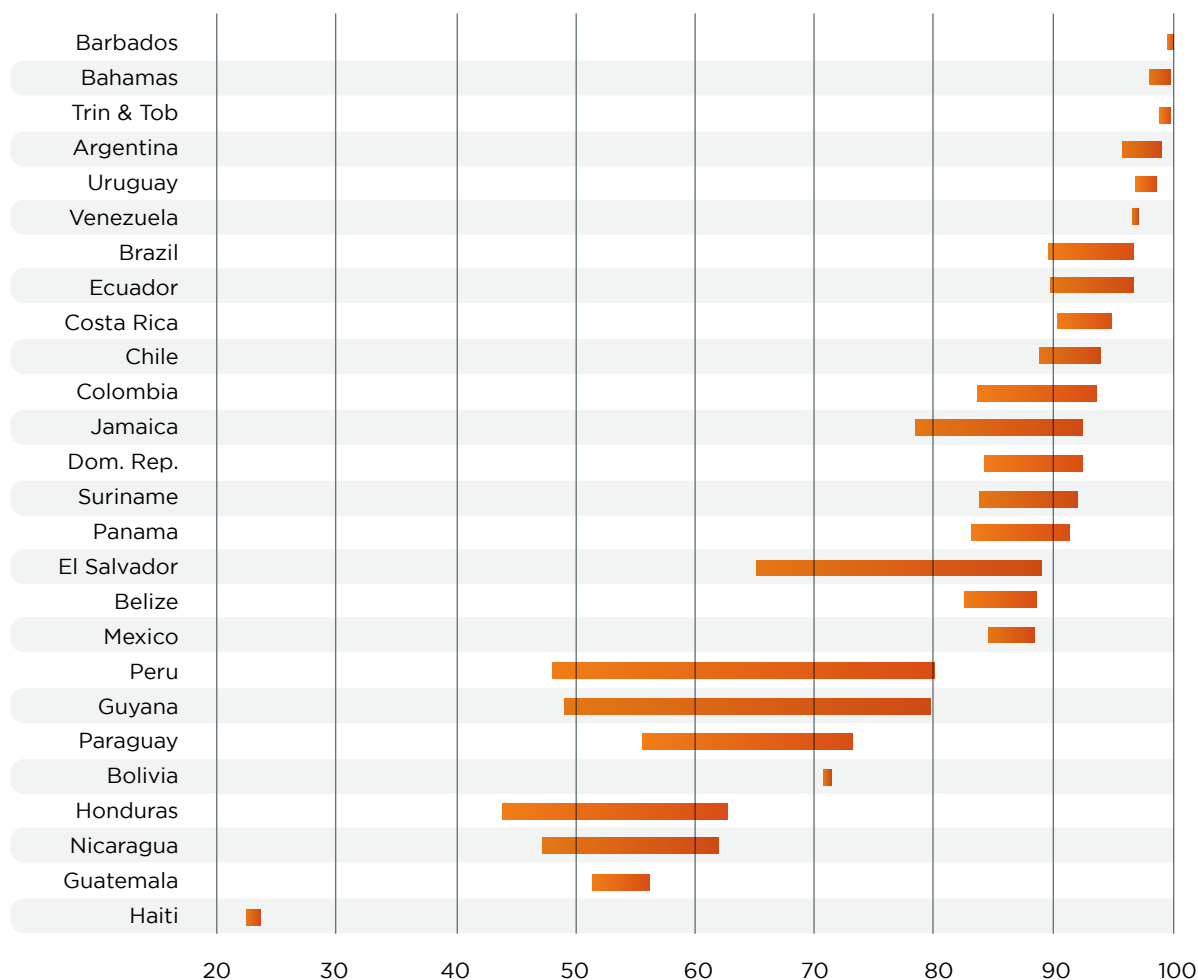


Figure 2. Access to clean fuels and technology for cooking: evolution rates in %, 2000-16
Source: Sanin (2019) using data from World Bank, SE4All database from WHO (2016)

8. The one case that stands apart from the other countries and where substantial number of households still use fuel wood, despite the country being close to universal electricity access, is Chile. This is especially the case of Chilean households located at the South of the capital of Santiago. However, in their case the fuel wood is mostly used for heating rather than cooking (Troncoso and Soares da Silva, 2017). In the present work we focus our attention on wood and other fuels that are exclusively used for cooking. This is, however, an interesting topic for further research.

9. For instance, in Guatemala, roughly 49% of firewood is extracted from natural forests, which has led to an increase in the price of firewood, including in rural areas (Levy, 2018).

2.2.2 Conceptual framework

In order to close the clean cooking access gap highlighted in Figure 2, different kind of strategies and policies were developed in LAC countries. Based on the literature describing these programs, we observe that there are three main variables that differentiate them, which are key choices for policy-makers: coverage, timing and subsidies¹⁰.

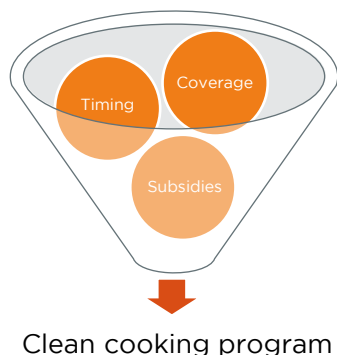


Figure 3. Suggested scheme for clean cooking program choices

- In terms of **coverage**, these can be either targeted or universal. When targeted, they usually focus on low income populations that mostly live in rural areas.
- **Timing** has to do with two aspects. The first one is whether the program includes pre-adoption and post-adoption phases, or whether it only focuses on the adoption phase. A pre-adoption phase would include marketing and communication on the upcoming program to raise awareness amongst future potential users; whereas the post-adoption phase has to do with the monitoring, follow up and maintenance in the period after the program implementation. The second aspect of the timing has to do with the duration of the program. Some programs are only applicable for a year, some have a five-year time span, and so on.
- **Subsidies** have to do with the kind of financial support that is part of the program. It can be only focused on the distribution of free or partially subsidized clean cooking stoves, and/or can include a fuel subsidy on the side. Subsidies have been an important part of the clean cooking policies and programs in LAC. Nonetheless, it is a complex matter and must be carefully designed. A misconceived and/or poorly targeted subsidy can be economically and environmentally unsustainable, generate important public deficits and increase inequalities. In the case of efficient cookstoves, subsidies can also lead to market distortions in two ways. First, they affect the incentives of manufacturers who seek to satisfy donors rather than users. By doing so, manufacturers intend to reduce costs at the expense of quality or improved features or design, which in turn affects the longevity of the cookstoves, which have no customer guarantee to start with. Second, the fact that the cookstoves are basically free diminishes the incentive of households to use them. They end up either being abandoned or used for other household purposes. Besides distorting the market, subsidies can be politically complicated if they are withdrawn after their implementation. This is particularly the case for fuel subsidies.

10. This classification was based on the literature review on the different clean cooking programs in LAC, including Wang et al (2013) and Puzzolo et al., (2013). It looks at several countries worldwide by assessing different types of cooking fuel, such as solid biomass, LPG, biogas and solar cookers and alcohol fuels. Countries of LAC that are included are Guatemala, Mexico, Peru, Brazil, Haiti and Nicaragua.

The literature extensively covers cases of fuel subsidies, which have been applied to different parts of the service chain. Subsidies can be applied to either the cylinder in the case of LPG, or to the actual bill in the case of electricity¹¹.

One example is Panama, with the non-universal LPG subsidy that was around 11% in 2013 (Troncoso and Soares da Silva, 2013). In El Salvador, the LPG subsidy has existed since 1974, when the price was fixed at subsidized rates for LPG cylinders of 12kg, when it was universal and when only 35 to 40% of the recovery prices were charged. After going through a reform in 2011, when the subsidy became targeted at consumers, in 2013-4, the subsidy became stricter, requiring registration in advance and a special permit when picking up the cylinder. Back then, the subsidy for LPG made up for 0.6% of national GDP (Ibid.).

Another subsidization program was that initiated by the Mexican government during 1984-2003 that provided subsidized tortillas to poor households living in urban areas of more than 15,000 inhabitants (Troncoso et al., 2019). The initiative had shown positive results in terms of savings of women's productive time and a reduced use of the typical biomass cooking stoves.

Another project related to clean cooking in Mexico was that of 2011, which consisted of the relocation of 1,000 households affected by a natural catastrophe in the State of Chiapas in Mexico to two new towns (Ibid.). In these two towns, each house built for the displaced people contained two pre-installed two-burner LPG stoves and one full 20kg LPG cylinder. Prior to the program, families were cooking with firewood. After the relocation and house change, despite the fact that all households continued to use firewood for cooking, 38% of them started using LPG. Out of these 38% using LPG, it is reported that on average 58% of their meals were cooked using LPG.

According to Troncoso et al. (2019) the program of subsidized tortillas in Mexico, along with that of households relocated to new homes that already include a LPG cooking stove, led to expected results in terms of the promotion of cooking with LPG in the Mexican context. As a consequence, the negative impact of firewood use on health was reduced. In the case of Mexico, however, no more substantive conclusions can be drawn on the impact of these programs, due to the absence of a public cost-benefit analysis.

A lot has been written about the adverse effects of energy subsidies, including in the specific case of LAC, arguing that these impose fiscal costs, impede competitiveness, harm state-owned enterprises and actually benefit higher income households, instead of the most vulnerable households (Feng et al, 2018; Di Bella et al., 2015; Marchan et al., 2017; Schaffitzel et al., 2019). Equally, clean cooking programs can also prove to be successful without fuel subsidies, as has been the case of the NAMA project in Guatemala, for example.

2.2.3 From concept to application: clean cooking program choices

We apply the scheme of clean cooking program choices described in Figure 3 to two case studies that are central to this study: Ecuador and Peru. To recall, the scheme is composed of three dimensions (coverage, timing, subsidies), on which policymakers make choices. These together determine the clean cooking program policy.

The purpose of this sub-section is twofold. On the one hand, it applies the conceptual scheme to real case studies, in order to give an illustration. On the other hand, it provides some background information on clean cooking programs in these two countries, to which

11. In their paper on LPG fuel subsidies in LAC more specifically, Troncoso and Soares da Silva (2017) provide a review of such policies for Argentina, Bolivia, Brazil, Dominican Republic, Ecuador, El Salvador, Mexico, Panama, Peru and Venezuela. In an IDB publication on the energy policies in LAC, Sanin (2019) also provides an overview of fuel subsidies by Latin America country during 2008-2014.

we return later in the empirical estimations. This can help provide some context for the interpretation and understanding of the estimations' results.

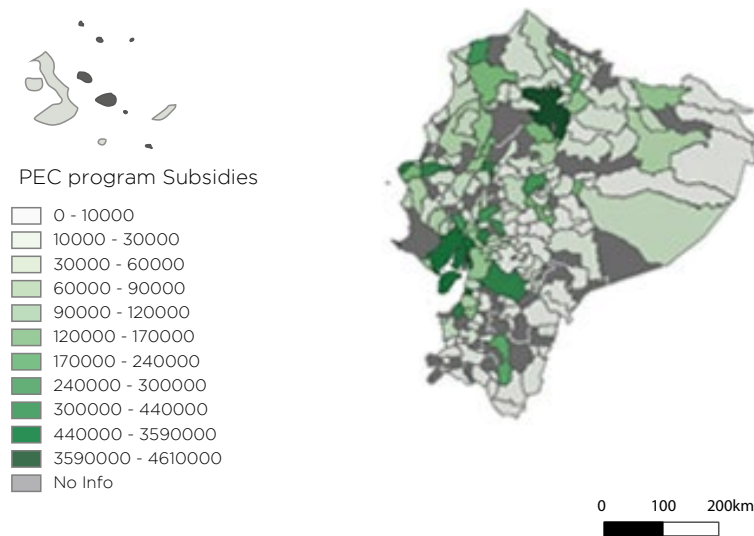
2.2.3.1 The case of Ecuador

Ecuador is a case study of Latin America where fuel subsidy has been present for a few decades. Since 1970, Ecuador has been subsidizing LPG cylinders of 15kg to guarantee fuels' affordability. In 2001, such cylinder was sold at a fixed price of 1.6 USD, regardless of the average international price. The increase in the international price of LPG with the maintenance of the fixed LPG cylinder subsidy has been costly for the Ecuadorian government, which imported the fuel at an international competitive price and sold it at a subsidized value internally. The imported fuel increased substantially, as well as the amount of fuel smuggled to the neighboring countries. This inevitable led to an increase in costs associated with LPG subsidies in Ecuador. As these are national subsidies accessible to any household, they have generated great inequalities and inefficiencies (Lema, 2010; Icaza and Morán, 2012).

Over the past years, given the need to reduce the LPG subsidy's tax burden, the Ecuadorian government proposed a solution that would force householders to take a step in the direction of modern and clean cooking practices (de Waziers and Tejeda, 2017). The government initiated the transition to electrical stoves through an induction stove program called PEC (see Box 1 more details). It aims to switch from considerably subsidized LPG cylinders to a subsidized high-efficiency induction electric stove through a financing scheme accompanied by a monthly fully subsidized electricity bill (Troncoso and Soares da Silva, 2013; Gould et al., 2018).

Considering the clean cooking program in Ecuador through the lens of the scheme described above, the program has general coverage, as the whole population is covered by the policy. In terms of timing, the program focused mainly on the pre-adoption phase. Finally, under the new program, there are general subsidies for electricity, though this condition is expected to be limited in time. The subsidies associated to the stoves particularly target low income populations. Otherwise, the program targets the whole population through loan schemes that allow to financially support consumers to transition to modern cooking stoves.

The PEC has two elements. First, it offers a subsidy that comes as electric credit where up to 80 kWh per month of electricity is offered for cooking purposes, and an additional 20 kWh if they chose to adopt both the electrical cookstove and an electrical heater. The Figure below shows how subsidies associated to the PEC program were distributed across the different regions of the country. Second, stove and cookware purchases benefit from a reduced price with an attractive payment plan (Gould et al., 2018). At the start of the program, according to ECLAC data, the consumption of wood was progressively being substituted by the use of LPG gas that remained heavily subsidized by the government. The subsidy fixed the prices of gas and therefore the progressive growth of the subsidy induced an ever-growing cost for government expenses. To curb this growth, the government set in motion the PEC Cookstove replacement plan that would help contain the increasing demand for LPG and shift it towards electricity while garnering the efficiency gains of this type of kitchens.



In 2014, an evaluation of the cooking habit of households found that a large number of users reportedly noticed a higher increase in the speed of cooking when using an electric cookstove and cited the fear of a gas leak as a noticeable concern of the use of LPG based stoves. This coincided with the security and time efficiency factors as a main driver of adoption mentioned in the literature review. Based on the baseline report published by Mindteck in 2009, the replacement of the cookstoves would save around 110 kwh/month in energy expenses. In that same study, given the choice between two different price levels with and without the subsidized cost of gas, the decision to switch kitchens dropped by 23%, showing the price elasticity of the adoption decision. The marginal effects of the experiment also showed that after the income restrictions to cover the costs related to the adoption of the clean stove had a female as the head of the household, they diminished the likelihood of switching to the new kitchen by 11.9%, countervailing the literature. The data pointed to a strong preference for the cookstove including the oven and the equipment necessary once the price of the LPG had increased to international prices. It also revealed that a large majority was in favor for switching from their current cookstove. The adoption of new cookstoves increased until 2018, when it reached a ceiling. An evaluation of the program is currently under way, to understand better the benefits and especially the barriers of the PEC development.

2.2.3.2 The case of Peru

In the case of Peru, the general clean cooking agenda and its progress is the result of a combination of several different programs, with each its own coverage, timing and subsidy type (when applicable). We briefly review each program below and, in each case, apply the conceptual scheme. More details about these programs can be found in Box 2.

The 2009-2011 clean cooking program known as the Campaign “Half a million Improved Kitchens for a Smokeless Peru” consisted of the distribution of certified improved kitchens, and not just standard improved kitchens with no guarantee. Its objective went beyond health, as it also included household consumption and savings, environmental pollution and intra-family dynamics. The program had a defined duration of two years and a broad coverage in terms of the groups of people targeted, i.e. families living in poverty and extreme poverty, and of all the regions it covered (14 in total, out of 25).

The time dimension of the Haku Wiñay/Noa Jayatai Project was different. It was of a longer and undefined time duration, with a start in 2012 and new initiatives in 2017. The coverage was the same as the campaign just described, with 14 regions covered in 2017, and poor and extremely poor households as the target. This project had the peculiarity that the beneficiary households could also take part in the kitchen building process, and that they were given additional equipment to improve kitchen lighting, on top of the stove.

One of the most known programs of clean cooking in Peru is the long-term undefined FISE program. It was created in 2012 and included an LPG cylinder voucher for the most vulnerable households. As an additional program, between 2014 and 2015, the Peru National Kitchen Program was implemented, targeting 82 municipalities. It included additional equipment that would be complemented by the already in place FISE program. Finally, the budget program called 0046 was different, as it looked at access to electricity for the most remote, usually rural, households. Its depth was on giving electricians and beneficiaries the rights skills to make the best use of access to electricity. These examples just show how from one program to another, all taking place in the same country, the timing, coverage and subsidy, when there is one, can vary.

For the EnDev Program, IPSOS (2012) identified that the fuel choice for improved cooking was firewood, which was used by all participants, although other biomass fuels were still used to a lesser extent, such as dry grass, champa or carca. Along the same lines, most beneficiaries stored firewood inside the home, mainly to protect it from rain. Fuel was usually obtained by collection or purchase, but those who opted for one practice did not necessarily rescind the other. This is why four out of five users (82%) had said that they collected it, but in turn 45% were buying it. It is important to underline that 19% of households had never collected firewood and that 55% of households had never bought it. Box 3 describes the EnDev program in Peru more broadly, as a complement to Box 2.

Most of the clean cooking programs in Peru were successful. This was the case of the EnDev program that ended in 2019, to the extent that households with improved stoves have significantly reduced the frequency of loading and collecting firewood, reducing fuel collection times, leading to more time being invested to other household activities. IPSOS (2013a) points out that households in which the program intervened had reduced their everyday firewood use from 25% to 11%. Also, once the improved kitchen was installed, households usually picked up firewood between once or twice a week, or less, frequently. Along these lines, Escobal et al. (2016) point out that through the implementation of improved kitchens, the use of firewood for cooking has been reduced, while fewer loads are used in homes. This change is directly attributable to the program.

With respect to the Haku Wiñay project, the use of firewood was reduced from 7.7 to 6.5 loads per month in households with program intervention, which is statistically significant and directly attributable to the program. As a more general result, IPSOS (2013b) estimated

a 21% money and time optimization indicator, meaning that households saved about a fifth of the resources they previously spent on obtaining fuel. From the installation of the improved kitchen, a significant reduction of the time required to obtain the firewood was recorded for the households that were collecting it, as well as significant savings for the households that were buying it.

On top of the different characteristics of these programs, their outcomes and success also showed to vary considerably from one case study to another. One recurrent problem identified in the literature is that of fuel stacking. The last section of this study looks at both pre-adoption and post-adoption barriers to clean cooking stoves programs, in order to conceptually explain why some households adopt the program initially and then drop out of it, or never adopt it. We do not seek here to make a case-by-case assessment of the reasons why programs in each country was a failure or success, but we find that there is considerable heterogeneity in the adoption outcomes of the clean cooking programs in LAC. One might argue that results of programs are all relative and that labelling a clean cooking stoves program as “successful” requires to set a threshold of the share of adoption, with consideration of households using a mix of traditional method and new technology, and with consideration of attrition levels. This is beyond the scope of this study, where we simply consider that the higher the adoption rate, whether exclusively of the new technology or mixed with the traditional cooking method, the higher the success of the program.

a) Campaign “Half a million Improved Kitchens for a Smokeless Peru”:

Between 2009 and 2011, this program was coordinated by the Technical Secretariat of the Inter-ministerial Commission of Social Affairs from the Presidency of the Council of Ministers. The program’s objective was to improve the quality of life of Peruvian families living in poverty and extreme poverty, massifying the use of certified improved kitchens. Among the main collaborators of the campaign are the EnDev Program, the National Program of Direct Support to the Poorest (JUNTOS), the Work and Family Institute and the Pan American Health Organization.

The impact on this campaign included health, socio-economic and socio-cultural benefits, such as the decrease in energy consumption, the saving of domestic fuel, the decrease in environmental pollution, the improvement in intra-family dynamics. The regions where the campaign worked were Huánuco, Pasco, Junín, Apurímac, Huancaavelica, Ayacucho, Puno, Cusco, Ancash, La Libertad, Cajamarca, Amazonas, Loreto and Piura.

b) Haku Wiñay/Noa Jayatai Project:

Project directed by FONCODES and designed to serve rural households living in poverty and extreme poverty. It started in 2012 within the framework of MIDIS strategies. One of the four components of the project focused on the improvement of healthy housing, insisting on the minimum health and well-being conditions for family members. The project installed improved kitchens where the beneficiary contributed with the construction of adobes and labor for the construction of the kitchen. Specifically, the project gave users a metal plate, a chimney and a transparent calamine to favor the kitchen lighting. In addition, as of 2017, FONCODES installed 51,650 improved stoves in the homes of users of the JUNTOS and Pensión 65 programs. This intervention was carried out in 14 departments of the country, with financing of US \$ 11.3 million of ordinary resources, through a MINEM financial transfer.

c) Social Energy Inclusion Fund (FISE):

Energy compensation system created in 2012 and intended to expand the energy frontier in the vulnerable population, through the massification of the use of natural gas, the development of new supplies at the energy frontier, the promotion for access

to LPG. Among its activities, it grants a discount voucher so that families can purchase a domestic gas container of up to 10 kg.

d) Peru National Kitchen Program:

Directed by the MINEM, this program was carried out between 2014 and 2015 with the purpose of delivering, to the most vulnerable families, a two-burner stove, a regulating valve, a 10 kg LPG cylinder and the initial load. This delivery is complemented by the FISE program while granting vouchers for subsequent LPG purchases.

The promoters of Cocina Peru reached 82 municipalities in the Arequipa region, 78 of Junín, 49 of Ayacucho, 47 of Ancash, 44 of Huánuco, 38 of Apurímac, 27 of Tacna, 19 of Huanavelica and 19 of Moquegua, among other regions visited, including Lambayeque.

e) Budget program 0046: Access and use of rural electrification:

Directed by the MINEM in coordination with regional and local governments, this program resulted in the rural, isolated and border population accessing the electricity service. Its activities include the inclusion of promotion and training actions for electricians and users.

Box 2. Summary of State-led Clean Cooking Programs in Peru

The Energizing Development Program in Peru

The Energizing Development Program (EnDev) is a global program funded by the governments of the Netherlands, Germany, Norway, United Kingdom, Switzerland and Sweden with intervention in 26 countries in Africa, Asia and Latin America. In Peru, it started its activities in 2007 and concluded in 2019. It was coordinated by the German Cooperation Agency (GIZ) in cooperation with the Dutch Cooperation agency.

The objective of the program was to facilitate sustainable access to modern energy, mainly for rural people. To this end, EnDev-Peru designed a strategy focused on developing direct business relationships between the potential demand for energy access and local suppliers of energy access technologies. It focused on three components: i) energy for lighting; ii) energy for cooking; and iii) the promotion of solar water heaters. The key activities of the project were on commercial promotion and to distinguish between retail demand and institutional demand.

In this sense, the design of EnDev-Peru's strategy focused on the creation of a framework to access Basic Energy Access Technologies in an integral way, based on three axes: 1) the institutional environment, 2) supply and 3) demand. The institutional environment tried to boost the market through the development of policies, standards, regulations and forms of financing for Basic Energy Access Technologies (TABE). The program aimed to boost the offer by developing business capabilities, providing information, as well as assuming financial risks and costs through monetary incentives managed by two funds created by the program. EnDev-Peru advised on the consolidation of its distribution and credit access structures, thus promoting the growth of an informed demand on TABE, as well as its access to financing mechanisms for the purchase of these technologies.

Actions performed by EnDev Peru were key in having a direct impact on the project's objectives, namely 1) enabling policies and regulatory frameworks; 2) validating innovation and technology; 3) providing financing mechanisms; 4) strengthening the distribution chain; and 5) developing capacity.

In terms of enabling policies and regulatory frameworks, political advocacy actions were carried out with representatives of regional and local governments, NGOs and

international organizations. With regards to the negative impacts of intra-residential pollution generated by traditional stoves and kitchens, the State issued an Emergency Decree, which allowed the use of public resources for the construction of improved kitchens. An additional objective was the incorporation of TABEs in budgetary programs and public investment projects.

With respect to innovation and technology validation, the characteristics of the technologies were improved, adapting them to the peri-urban and rural demand. This contributed to the consolidation of companies in the TABE market. The program was also promoted in regulated (and unregulated) financial institutions, leading to the development and inclusion of financial products and services that would allow families to acquire technologies and companies to boost their ventures.

Additionally, the distribution chains of the TABE were boosted and strengthened, articulating local entrepreneurs (wholesalers and retailers with existing businesses) with importers and manufacturers that were already in the local market.

Finally, the strategy focused on developing capacity by promoting the development of managerial skills, technicians and leaders related to social programs that implemented massive projects for TABE, through training and the incorporation of new courses in the curriculum of public and private training institutions. These courses covered the construction of improved kitchens, the installation of photovoltaic systems and internal electrical connections, as well as the improvement of business management.

Specifically, based on the strategy described, EnDev-Peru contributed to generate changes in the use of clean fuels at different levels, as the table below showing the impact results of the program up until June 2018 illustrates:

| Level | Description |
|----------------------------------|--|
| Institutional environment | Generation of evidence for the inclusion of improved kitchens in the 0118 budget program, through which financing for the installation of improved kitchens is secured as part of the Haku Wiñay Noa Jayatai Project of MIDIS. |
| | Preparation of the proposed Technical Standard to ensure the quality and certification of improved kitchens, which resulted in Supreme Decree No. 015-2009. |
| | Insertion of improved portable kitchens in social programs such as the National School Food Program (Qali Warma) |
| Demand | 1 463 532 people with access to energy for cooking and solar thermal baths in homes |
| Offer | 1 136 men and 359 women were trained in construction of improved kitchens. |

Source: Amaray Special Closing Edition (2018, p.32)



3 WHO LACKS CLEAN COOKING STOVES?

This section seeks to provide an overview of the socio-economic characteristics of the population lacking clean cooking stoves. Three questions are addressed:

- (1) Is there heterogeneity between the poorest households that continue to use wood on the one hand, and the one that had adopted improved kitchens on the other hand?*
- (2) What are the best predictors of pertaining to the poorest household that have “made the move” and adopted improved kitchens with firewood?*
- (3) Can income, one of the most important barriers to adoption based on the existing literature, be a driver in the adoption of cleaner cooking methods?*

The focus is on the cases of Guatemala, Peru and Ecuador. We chose these countries for several reasons. First, we had access to complementary data on the programs that have been implemented in each country, which gives some context to the analysis. Second, they are all included in a harmonized household survey database that we used in the empirical estimations. Third, we were able to organize a mission and carry out semi-structured interviews in Guatemala, thanks to ongoing projects. This allowed us to complement the quantitative analysis on Guatemala with evidence collected from the qualitative survey carried out during a mission, on which more information can be found in the Appendix. Ecuador, for its part, represents a case of its own because of the LPG subsidy and the government's attempt to remove it and promote electrical stoves instead. Peru is one of the countries that has many different clean cooking programs, and which would also fit in the successful category of clean cooking programs, as per our definition above.

For each case study, first brief descriptive statistics are presented. Second, we look at the underlying differences of poor cookers using Latent Decomposition Analysis (LCA). Third, logistics regression analysis allows us to identify who the adopters are. Finally, we compare our “clean cookingness” index to the level of household income by relying on Principal Component Analysis (PCA) to see whether income affects the probability of adopting. The same steps are repeated for each case study. The detailed methods and results' tables are presented in the Appendix. Before looking at the empirical analysis, a brief description of the data and methodology is given. The methodology includes the methods of Latent

Composition Analysis (LCA), logistics regression analysis and Patent Composition Analysis (PCA). These methods are presented in more details in Appendices 2, 3 and 4 of this document, respectively, along with the tables of results.

3.1 Household data

The data we use for our case studies is at the household level and has been harmonized across the period 2010 to 2018. All data come from countries' national household surveys. The individuals who replied to the survey questions are either members of the household or head of the household. One of the contributions of the present work is the fact that all household data surveys were harmonized, facilitating the repetition of the analytical exercise, and allowing for comparability between the results.

The datasets contain over a hundred variables, mostly capturing characteristics of the household composition, incomes of the different members and information on the appliances, amongst others. The descriptive statistics of the variables we use in the present study are summarized in each country section. The majority are user-written, whereas others such as those on income, came as such in local currency. All binary variables are user-written and were built in such a way that is relevant for the analysis we want to do.

Our key variable to estimate clean cooking is binary and takes the value 1 if the fuel used for cooking is wood, and 0 if it is gas or electricity. Unfortunately, even though we know that there are three different types of kitchens that require fuel wood, as was described earlier, the survey data do not distinguish between these three types. To recall, these are the open fire pit, the "homemade" or low-maintenance improved kitchen and the manufactured improved kitchen. The variable for zone indicates if the household is located in an urban or a rural area. The elder variable looks at the age of the head of the household and at whether she or he is older than the mean of all household heads, or younger or has the same age.

The variable on gender looks at whether the person surveyed is a woman or a man. We also have this information for the head of the household. We consider the household to be big if it has the same or more household members than the national average. Information on the level of education of the household member, whether the dwelling is rented or owned, the type of dwelling, and whether bins are collected by public services is also available. Finally, we have both the income of the household as a whole, and that of the individual being surveyed. One variable that we used to narrow down our empirical analysis to poor households only was a binary variable 'poor' that was based on whether the household income was lower or higher than the poverty line¹². The sample is restricted to households that met the "poor" condition and had an income below the national poverty line.

3.2 Methodology

To answer the broader research question on which households are the one that adopt clean cooking, we use three different methods. These are Latent Composition Analysis (LCA), logistics regression analysis and Patent Composition Analysis (PCA). LCA allows for the analysis of sub-groups of adopters and non-adopters amongst the poorest households. To assess the likelihood of households transitioning to clean cooking according to their different characteristics, we rely on logistics regression analysis. Finally, PCA is used for the analysis of the link between income and a "clean cookingness" index.

12. Unfortunately, data on the poverty line in Guatemala is only available for the year 2011 in our harmonized household data-base. We use the value as a benchmark for all our years, assuming that it has not changed significantly over the period of nine years. For Peru and Ecuador, the poverty line is available for all years during 2010-2018.

Based on the existing literature, the people who are the most likely to be using solid fuels for cooking are those who are poor and with very little access to clean fuels (Troncoso and Soares da Silva, 2017). For these same households, even when access is granted, financial means remain an obstacle, as they cannot afford to pay for LPG or electricity. Here we only look at the poorer households, those whose income falls below the national poverty line.

The purpose of the first empirical analysis is to show that within each sub-group of poor households that use firewood versus non-firewood (i.e. gas or electricity), there are other sub-groups or households, showing considerable heterogeneity amongst the users. In order to carry out this analysis, we use Latent Composition Analysis (henceforth LCA), which is a sub-model of the general finite mixture model (FMM) (see Appendix 2 for more details). It allows to test whether our observations of wood or non-firewood users come from different, but unobserved, subpopulations (i.e. classes).

Because all of the different characteristics of households seem to vary within each sub-group of poor households, as results below reveal, we try to evaluate how each of these might be contributing to the likelihood that the household switches from using firewood to gas or electricity, therefore looking at “who made the move”, by relying on logistics regression analysis (see Appendix 3 for more details).

The previous empirical analyses using LCA and logistics regression analysis look at different household characteristics or conditions that increased the probability that poor households would adopt clean cooking, meaning transit from using wood as a cooking fuel to using gas or electricity. However, as findings below show, there are potential limitations to these analyses in terms of their policy implications, because some of these characteristics are less time variant. Therefore, in a third empirical analysis, we want to test the impacts that an increase in individual income can have on making clean cooking more likely. To carry out our analysis, we created an index that measures the likelihood of “clean cookingness”, based on PCA (see Appendix 4 for more details).

3.3 Empirical analysis

In this section we repeat the three analytical exercises just presented for each of our three case studies. We explore the data and variables used, and then look at differences between poor cookers, followed by who is more likely to adopt, and finally whether income is a determinant of the adoption of clean cooking stoves. We first look at Guatemala, then move to Peru and conclude with Ecuador.

3.3.1 Guatemala

The analysis on Guatemala offers a mix of both quantitative and qualitative methods. Whereas we depart from the quantitative analysis, we use the qualitative information to support and complement it. The qualitative information is to be taken with a pinch of salt, as it was collected from a reduced population sample, and other factors also play a role in the potential biasedness of some of the findings. It is nonetheless useful, as it gives a fresh perspective on some of the results and offer some interpretation of the findings.

3.3.1.1 Descriptive statistics

Data for Guatemala comes from the ENEI household data survey that covers the period 2010-2018. Table 3 below shows some of the descriptive statistics for the weighted data survey. The column on the very right shows the percentage share of the population that replied “Yes” to the survey question, except for the last two variables on income where just the maximum is shown. Figure 4 shows the distribution of some characteristics of the poorer households, also using weights.

| Variable | Observations | Mean | Std. Dev. | % if x=1 (or max.) |
|--|--------------|----------|-----------|-----------------------|
| Fuel wood (Yes=1) | 165,569 | 0.536 | 0.499 | 62% |
| Poor (Yes=1) | 165,586 | 0.889 | 0.314 | 90% |
| Zone (urban=1) | 165,586 | 0.604 | 0.489 | 50% |
| Elder (Yes=1) | 165,586 | 0.098 | 0.297 | 9% |
| Sex (Male=1) | 165,586 | 1.513 | 0.500 | 49% |
| Head of household (Yes=1) | 165,586 | 0.215 | 0.411 | 21% |
| Female head of household (Yes=1) | 35,603 | 0.205 | 0.404 | 19% |
| Household size (Larger than average=1) | 165,586 | 0.449 | 0.497 | 48% |
| Dwelling (House or apartment=1) | 165,586 | 0.898 | 0.303 | 90% |
| Education (None=1, Primary=2, Secondary=3, Tertiary=4) | 135,909 | 2.264 | 0.777 | 17% |
| Home ownership (Yes=1) | 165,586 | 0.855 | 0.352 | 89% |
| Bin collection (Yes=1) | 165,586 | 0.471 | 0.499 | 38% |
| Household income | 165,586 | 4466.038 | 5950.260 | 204667 |
| Individual income | 61,698 | 2482.731 | 3688.201 | 200000 |

Table 3. Descriptive statistics of our variables of interest for Guatemala (using weights)

As Table 3 shows, in Guatemala 62% of the population uses firewood. Nine households out of ten are considered to be poor. About half of the population lives in urban areas and a fifth of household heads are women. In terms of education, almost a fifth of the population did not attend primary education. With respect to bin collection, only 38% of households report to have such system where they live. Comparing these numbers to Figure 4 does not make a big difference, as 90% of the population is considered poor, and as Figure 4 shows the same characteristics for that category of the population. It is only worth noting that one percentage point more of the population reports no education and four percentage points less has a system of bin collection.

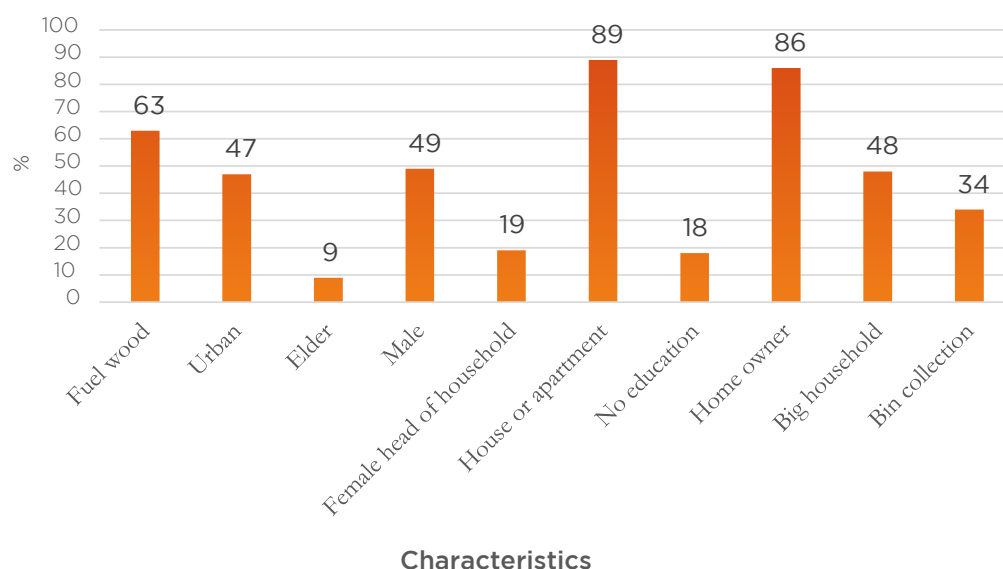


Figure 4. Characteristics of poor households in Guatemala (149,702 in total, using weights)

3.3.1.2 Differences between poor cookers

The LCA analysis shows that when looking at the probability of pertaining to each class of the sub-group of poor households that use firewood, what comes out from the results is that within those that use wood as a cooking fuel, there are two types of households. On the one hand, there are those that are located in rural areas, with a larger household, less chance of living in a house or department, more likely to be owning their dwelling, and no bin collection system. On the other hand stand poor households who use firewood, are located in urban areas with an older household head, are a smaller household in terms of the number of members, and have less chance of being the owner of the house or apartment or a bin collection system (see Appendix 2.1).

When looking at the sub-group of poor households that use either gas or electricity, there are two types of households. One of them is located in an urban area, has an older household head, smaller household, less chance of being an owner of the dwelling, and a bin collection system in the area. By contrast, the other type of household is rural, with a slightly younger household head, more household members, more chance of being the owner of where they live, and no bin collection system (see Appendix 2.2).

It is worth noting that the differences between the two classes of each sub-group of poor households are similar. Those living in urban areas usually have an older household head, less household members, are less likely to be a property owner and live in an area where there is a public bin collection system. Another interesting observation is that despite the findings in the literature, wood users are also located in urban areas, and vice versa, where electricity or gas users are also present in rural areas.

These results are important for policy-making that is related to clean cooking. They reveal considerable heterogeneity amongst the households that use firewood and hence that are targeted for clean cooking programs, and those that already use gas or electricity, and that are sometimes considered as successful cases of the adoption of cleaner cooking. The next section focuses on the households that 'made the move' by adoption gas or electricity and look at conditions that can potentially increase the probability of the poor household adopting modern cooking.

3.3.1.3 Who made the move?

Marginal effects presented in Appendix 3.1 show that urbanization is a strong driver of adoption, as evidence in the existing literature shows (Puzzolo et al., 2013). The result can be interpreted such that the fact of living in an urban area, *ceteris paribus*, will increase the probability of adopting the modern cooking by 26 pp. Having a head of the household that is older than the average also increases the likelihood of adopting. If the household head is a woman, the probability increases by 15 pp. Living in a house or apartment, being more educated and having a bin collection system are all driver factors of modern cooking adoption. A higher income also plays a significant role. By contrast, if the household members' number is more than 5, which is the national average in Guatemala based on our data, and if the dwelling is owned by its tenants, the probability of adopting decreases.

Two of the findings from these results might seem counter-intuitive and have not always been supported by the existing literature. These are the fact that the older the household head, the higher the adoption, and that the adoption is also higher when the person does not own the place (i.e. they rent it out). Our qualitative survey helps us shed some light on these counter-intuitive results, in spite of the fact that the fieldwork only looked at the transition from fuel wood open fire pit to improved kitchens, whereas our empirical results are for the transition from fuel wood to LPG or electricity.

It came to our attention that in many cases of the adoption of improved kitchens in the communities surveyed in Guatemala, the idea to adopt had come from the mother or the grandmother who was already using an improved kitchen before their (grand-)daughter. We can think of two reasons why the elderly relative is more likely to adopt than the younger relative. First, it has to do with income, as the older the household head, the higher the income accumulated and saved, and hence the higher the affordability of a transition. Second, the elderly might be more aware of the health-related issues caused by using dirty cooking methods, as they might already be experiencing the long-term health effects of being exposed to these methods, thereby motivating their transition to cleaner cooking methods. In fact, in several of our interviews, the mothers reported headaches, high blood pressure, considerable coughing accompanied by "black mucus" and eye redness and pain that they associated to the smoke emerging from their dirty kitchen stoves (see the interviews in Appendix 5 for the reported answers).

The second result that is less intuitive is the fact that not owning the house increases the likelihood to adopt clean cooking stoves. One experience that was narrated in the interviews we carried out was that prior to buying their own house, the family was renting out a place, and that this place had an improved kitchen stove. This later incentivized the family to also get one when they bought their own house. This suggests that homes that are rented out have more or better equipment that is more modern, such as improved kitchen stoves. This would explain why in this case families living in rented homes are more likely to have adopted modern cooking, especially if they upgraded their living environment when renting a new place out.

The rest of our empirical findings go hand in hand with evidence in the literature. We return to some of the barriers that, if overcome, can help drive adoption. This is discussed in section 5 of the present study. Our results have important policy implications, especially as they quantify by how much the probability of adopting increases with each change in the household characteristics or conditions. Nonetheless, some of the limitations we are faced with now are that most of these characteristics cannot be changed *per se*. That is, how does one justify a policy that relocates to urban areas, or increases the age of the household head, or makes sure she is a woman, or decreases the number of household members?

Living conditions, such as having a public bin collection system, can be improved. Empowering women so that they can also become breadwinners can also contribute to modern cooking adoption. The next question that arises then is where to start. One element that is straightforward and where governments can intervene and have a significant impact on adoption is by raising individual income. The next section provides empirical evidence on this policy suggestion.

3.3.1.4 Clean Cookingness Index

As shown in Appendix 4.1, the index that measures “Clean cookingness” varies as the individual’s income increases. Only poor households are looked at in the empirical analysis. Individual income is measured in local currency.

The most striking feature has to do with the smoothening line of all the observations. It shows that an increase in income only helps households pick up clean cooking if it happens at income levels below 4,000 Quetzals (roughly five hundred US dollars), after which the line flattens. This means that an income distribution policy, for instance, is only effective in terms of clean cooking adoption if it is directed at households that make less than 4,000 Quetzals. This finding has important implications for policy-making, especially for programs such as conditional cash transfers that might be accompanying clean cooking stoves distribution and/or credit for gas or electricity subsidies.

3.3.2 Peru

This section on the case of Peru is different to the two other ones to the extent that it provides some information on the programs that were implemented and more description coming from other sources on the characteristics of households that were affected by the programs or those that adopted.

It is worth noting that in Peru, initiatives for the adoption and implementation of programs related to clean cooking and improved kitchens are relatively new. In the 1980s, civil society and some NGOs began implementing programs to boost the use of improved stoves (Microsol, 2018:56). The matter became relevant in 2007, when the World Bank recommended that the Peruvian State invest in replacing traditional kitchens used in the Andes (which produce indoor smoke pollution) and encouraging the use of improved kitchens.

First, descriptive statistics and data are presented. They are then followed by the different characteristics of poor cookers, analysis on who adopted, and finally the link between the “clean cookingness” index and household income.

3.3.2.1 Descriptive statistics

Several initiatives have been implemented in the country with notable progress, since in Peru traditional kitchens have been the main instrument for preparing food in poor households, primarily located in rural areas of the Andes and forests. On another front, access to electricity in Peru has increased from 92.3% in 2013 to 95.1% in 2017 (ENAH0, 2017). However, there is a significant percentage difference between the different areas of residence. While 99.2% of urban area residents accessed electric power in 2017, in the rural area it was only 81.2% (INEI, 2017).

| Fuel | 2007 | 2017 |
|---------------------------------------|-------|-------|
| Gas | 55.6% | 76.3% |
| Wood | 30.2% | 17.3% |
| Others (coal, dung, branches, leaves) | 14.2% | 6.4% |

Table 4. Type of fuel for cooking between 2007 and 2017

Source: Elaborated with information of Census 2007 and 2017- INEI

With regards to the clean cooking issue, recent years indicate significant progress in closing gaps in the use of harmful fuels. For example, between 2007 and 2017, the use of clean fuels increased by 20pp nationwide (Table 4). According to the 2017 National Census, households that use gas to cook food are in the departments of Ica (89%), Tumbes (88%), Tacna (84%), Lima Region (84%), Lambayeque (81%) and Moquegua (79%). These regions are located on the coast and show some economic development.

Along these lines, regions with higher levels of poverty have made progress in closing this gap. For example, Loreto improved from 27% of households that use clean fuels in 2007 to 49% in 2017, Amazonas from 22% to 49%, Apurímac from 15% to 44%, Cajamarca from 21% to 40% and Huancavelica from 12% to 34% (INEI, 2017). However, these regions still maintain significant gaps, since less than 50% of households use gas to cook food.

According to the National Household Survey (ENAH) 2018, less than 11% of the Peruvian population uses electric energy for cooking (Figure 5). In households classified as “non-poor”, 90% of households in the urban area use gas for cooking; while in the rural area 64% use coal, firewood, and other polluting fuels. With regards to households with scarce resources classified as “poor”, 88% of households in the rural area use coal, firewood, and other polluting fuels. Apparently, so far, although there is an increase in the use of clean fuels nationwide, there are still substantial differences in households that are considered vulnerable.

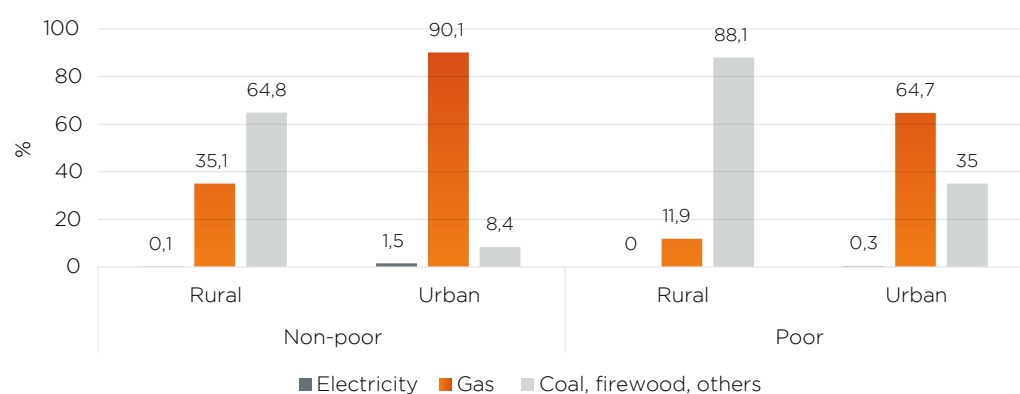


Figure 5. Households that frequently use coal, firewood, among other fuels for cooking, by area of residence and poverty level

Source: Elaborated with information from ENAH 2018- INEI

The percentage households out of the total census population for the year 2017 that cooks with fuels pollutants is 20%. With respect to age, the percentage is highest for children aged between 6 and 17 years old, meaning both young children and adolescents, and lowest for women of childbearing age, followed by inhabitants aged 90 or more (Table 5). With respect to education, almost half (44%) of those that use fuels pollutants for cooking attended primary school only, while a fifth reported no level of education, and a mere 3% went beyond high school education (Figure 6).

| Special age group | % (regarding each age group) | Population in households that use polluting fuels | Census Population |
|---------------------------------------|------------------------------|---|-------------------|
| Childhood and adolescence | | | |
| 0 to 5 | 23,1 | 692 782 | 2 995 217 |
| 6 to 11 | 24,9 | 783 988 | 3 152 015 |
| 12 to 17 | 24,7 | 728 602 | 2 945 446 |
| Women of childbearing age | | | |
| 15 to 49 | 17,4 | 1 323 862 | 7 623 074 |
| Old age | | | |
| 60 or older | 22,6 | 775 779 | 3 433 833 |
| Fourth age | | | |
| 80 to 90 | 23,7 | 116 643 | 493 069 |
| Longevity | | | |
| 90 or older | 19,6 | 17 060 | 86 972 |
| Total population in households | 20,3 | 5 786 689 | 28 574 337 |

Table 5. Population in households that cook with fuels pollutants, according to special age groups in 2017
Source: INEI – Census 2017

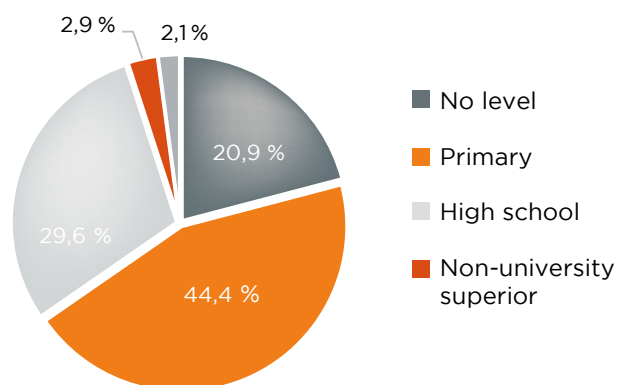


Figure 6. Population of 15 years and older in households that cook with fuels pollutants, for the last level of study that approved in 2017
Source: INEI – Census 2017

| Mother tongue | Total | % | Urban | % | Rural | % |
|------------------------------------|-----------|-----|-----------|-----|-----------|-----|
| National | 5 460 095 | 100 | 1 512 892 | 100 | 3 947 203 | 100 |
| Spanish | 3 515 778 | 64 | 1 176 942 | 78 | 2 338 836 | 59 |
| Quechua | 1 574 470 | 29 | 295 000 | 20 | 1 279 470 | 32 |
| Aimara | 159 452 | 3 | 22 456 | 2 | 136 996 | 4 |
| Another native language | 191 877 | 4 | 13 218 | 1 | 178 659 | 5 |
| Other language or foreign language | 871 | - | 317 | - | 554 | - |
| Not listen or speak | 8 166 | 0 | 2 181 | 0 | 5 985 | 0.2 |
| Sign Language | 2 923 | 0 | 773 | 0 | 2 150 | 0 |
| NA | 6 558 | 0 | 2 005 | 0 | 4 553 | 0 |

Table 6. Population of 3 years or older in households that cook with fuels pollutants, by residence area, according to maternal language learned in childhood in 2017

Source: INEI – Census 2017

Table 6 also reveals that in rural areas, the share of indigenous populations that cook with fuel pollutants is higher, as shown in the percentage shares of the population that speaks either Quechua, Aimara or another native language. The adoption of clean cooking amongst these populations might be lower than for rural populations that are not indigenous because of traditional and cultural barriers to clean cooking adoption, as described in Section 5. This is because indigenous populations tend to adhere more to their traditions and cultural practices. Data for Peru used in the empirical estimations come from the ENAHO household data survey that covers the period 2010-2018. Table 7 below shows some of their descriptive statistics. In the case of Peru, the variable on collected bins did not exist in the survey, and the household income was too skewed to the right, because of households answering zero as their income, or some data reporting issue. Consequently, observations that reported zero as their household income were dropped.

The column on the very right-hand side shows the percentage share of households that replied “Yes” to the questions (variables) on the left-hand side. These include populations weights and are applied to the whole population. Figure 7 focuses on shares of characteristics of only poor households.

| Variable | Observations | Mean | Std. Dev. | % if x=1 (or max.) |
|--|--------------|---------|-----------|-----------------------|
| Fuel wood (Yes=1) | 981,320 | 0.31 | 0.46 | 22% |
| Poor (Yes=1) | 1,007,064 | 0.15 | 0.35 | 11% |
| Zone (urban=1) | 1,007,064 | 0.61 | 0.49 | 75% |
| Elder (Yes=1) | 1,007,064 | 0.12 | 0.33 | 12% |
| Sex (Male=1) | 1,007,064 | 1.51 | 0.50 | 49% |
| Head of household (Yes=1) | 1,007,064 | 0.26 | 0.44 | 26% |
| Female head of household (Yes=1) | 256,956 | 0.24 | 0.43 | 26% |
| Household size (Larger than average=1) | 1,007,064 | 0.53 | 0.50 | 53% |
| Dwelling (House or apartment=1) | 992,170 | 0.92 | 0.28 | 92% |
| Education (None=1, Primary=2, Secondary=3, Tertiary=4) | 938,939 | 2.56 | 0.92 | 12% |
| Home ownership (Yes=1) | 992,404 | 0.93 | 0.25 | 92% |
| Household income | 1,007,064 | 1920.37 | 2535.11 | 251,940 |
| Individual income | 1,007,064 | 435.72 | 1041.66 | 91,726 |

Table 7. Descriptive statistics of our variables of interest for Peru (using weights)

Table 7 shows that one fifth of households in Peru use fuel wood and that only one household out of ten is considered poor, according to the national poverty line. Three quarters of the population lives in urban areas, one household out of four has a female household head, and a tenth of the population received no education.

Comparing these numbers to those in Figure 7 is interesting, to the extent that it shows characteristics of poorer households relative to the whole population. For instance, half of poor households use fuel wood, against a fifth for the national average. Poor households are concentrated in rural areas, have an older household head, a higher share of female household heads and less educated members, compared to the national average.



Figure 7. Characteristics of the poor households in Peru (109,068 in total, using weights)

3.3.2.2 Differences in poor cookers

Looking at the probability of pertaining to each class of the sub-group of poor households that use firewood reveals that within those that use wood as a cooking fuel, there are two types of households. Based on the econometric results, living in a rural or urban area is not a determining factor as strong as other characteristics, such as the age of the household head, the size of the household and the type of house in the case of Peruvian households. For an older household head, the household number is less, and the case is more likely to be a house or apartment and slightly more likely to be in an urban area (see Appendix 2.3).

There is significant difference among the population the lack access to clean cooking. However, it can be grouped under two sub-group of poor households: (1) in urban area, the older owner and small size houses; (2) in the rural area, younger without ownership in bigger houses (see Appendix 2.4).

3.3.2.3 Who made the move?

In terms of improved kitchen adoption, intervention programs have made significant progress in the use and transition of households to this type of technology. In the evaluation carried out for the EnDev Program, IPSOS (2013b) has estimated a use rate of 79% and a maintenance rate of 56%, indicating that the households that had the Endev-Peru intervention positively assimilated the transit of a traditional kitchen to an improved kitchen. Along these lines, in the impact assessment carried out for the Haku Wiñay program, Ponce and Escobal (2016), also found significant progress in the use of an improved kitchen. However, since households not affected by the program also increased their use, this percentage of progress is not statistically attributable to the intervention. IPSOS (2013b) nevertheless estimated a penetration rate of 36%, highlighting that the improved kitchen adoption can still be spread to many users. Along the same line, IPSOS (2013b) estimated a reduction in biomass burning between 40% to 60%, depending on the type of kitchen.

Despite the adoption of an improved kitchen, households also show the use of other types of kitchens. In the evaluation of the level of information and maintenance of improved kitchens by Endev-Peru, IPSOS (2013c) identifies that households also use other types of kitchens, like the stove when necessary or gas, if they were migrating to this technology. In the same

study, IPSOS (2013c) has identified a significant proportion of beneficiaries who stopped using the improved kitchen permanently, indicating that, in general, after the second year of installation, the frequency of use is reduced slightly¹³. This finding is important, as it may mean a migration to gas cooking technologies or traditional kitchens.

For the FISE program, Hollada et al. (2017) identify that, especially in resource-poor settings, exclusive adoption of clean cooking technologies is not common. In the same line, Calzada & Sanz (2018) show that the FISE program favored the adoption of the LPG cookstoves, but that many households still combined their use with traditional cookstoves. This problem of attrition seems to be endemic to most case studies in Latin America and the Caribbean. We describe barriers to post-adoption, which can lead to attrition, in section 5 below.

As marginal effects from Appendix 3.2 show, the probability of adopting cleaner cooking methods increases if the household is located in an urban area, if the household head is older, the household head is a female, there are less household members than the national average, the dwelling is a house or an apartment, the household head is more educated and if the home is not owned. Most of these findings go hand in hand with evidence in the literature.

3.3.2.4 Clean Cookingness Index

Findings from Appendix 4.2 show that in the case of Peru, income is not necessarily the biggest driver behind the adoption of clean cooking stoves. The fitting line is rather flat, except for a small drop at the beginning. This result differs greatly from what we had found in the case of Guatemala, where the adoption of clean cooking was much more likely if there was an increase in income in households at the very bottom of the distribution. Peru shows a different story that would require further analysis and interpretation.

3.3.3 Ecuador

Ecuador represents a case on its own, to the extent that most of the households use gas, specifically LPG, and that the government subsidizes LPG, as was described in Section 2. It nonetheless plans to move to electrical stoves by providing subsidies for these, as well as for electricity bills. Even though the majority of households use gas in Ecuador, for the sake of comparison with our other two case studies, we also focused on the adoption of gas from those that traditionally used wood with or without an improved kitchen stove.

Disclaimer: It had initially been part of the plan to organize a mission to Ecuador towards the end of 2019, similar to that in Guatemala, but due to unforeseen social events and political instability, we were not able to concretize this project.

13. Specifically, the proportion of households that stopped using the improved kitchen was 25% in Moquegua, 10% in Tacna and 12% in Arequipa.

3.3.3.1 Descriptive statistics

Data for Ecuador comes from the ENEMDU household data survey covering the period 2010-2018. Table 8 below shows some of the descriptive statistics using population weights. In the case of Ecuador, we removed the variable on the size of the household because the number of household members reported had some flaws, as it included values as high as 2,000.

As we did not have enough information on the average household size in Ecuador to make a selected cut-off, we chose instead to remove this variable from the analysis. The variable on household income was also amended, as it was too skewed to the right, because of households answering zero as their income, or some data reporting issue, hence we dropped observations that reported zero as their household income.

The column far-right of the table shows the percentage shares of households that replied “Yes” to the question on the far-left column, and the maximum replied for both household and individual incomes. Figure 8 suggests a zoom into characteristics of poor households by looking at the distribution per attribute.

| Variable | Observations | Mean | Std. Dev. | % if x=1 (or max.) |
|--|--------------|----------|-----------|-----------------------|
| Fuel wood | 761,364 | 0.065 | 0.246 | 5% |
| Poor (Yes=1) | 761,364 | 0.046 | 0.209 | 3% |
| Zone (urban=1) | 761,364 | 0.577 | 0.494 | 67% |
| Elder (Yes=1) | 761,364 | 0.120 | 0.325 | 12% |
| Sex (Male=1) | 761,364 | 1.502 | 0.500 | 50% |
| Head of household (Yes=1) | 761,364 | 0.256 | 0.436 | 26% |
| Female head of household (Yes=1) | 194,666 | 0.236 | 0.425 | 25% |
| Dwelling (House or apartment=1) | 761,364 | 0.873 | 0.333 | 88% |
| Education (None=1, Primary=2, Secondary=3, Tertiary=4) | 694,719 | 2.541 | 0.839 | 9% |
| Home ownership (Yes=1) | 679,761 | 0.842 | 0.365 | 83% |
| Bin collection (Yes=1) | 761,364 | 0.798 | 0.402 | 83% |
| Household income | 761,364 | 3611.488 | 23393.100 | 429034 |
| Individual income | 312,918 | 421.624 | 684.151 | 100000 |

Table 8. Descriptive statistics of our variables of interest for Ecuador (using weights)

Descriptive statistics for the whole Ecuadorian population show that only 5% of the population uses fuel wood, which is not surprising considering the LPG subsidy situation described in Section 2. Only 3% of the population lives below the national poverty line. One fifth of households have a female head, a tenth of the population has no education and a bit more than four fifth of the population benefit from a system of bin collection.

When zooming into the 3% of households that are poor, these characteristics look very different. A fifth of poor households use fuel wood, the population is considered older, the share of female household heads is considerably higher (from 25% to 43%), as well as the share of uneducated household members. Less households also benefit from the bin collection system, which is reduced to 58%. These differences in shares are not surprising, as those for the poor households only represent 3% of the population sample.

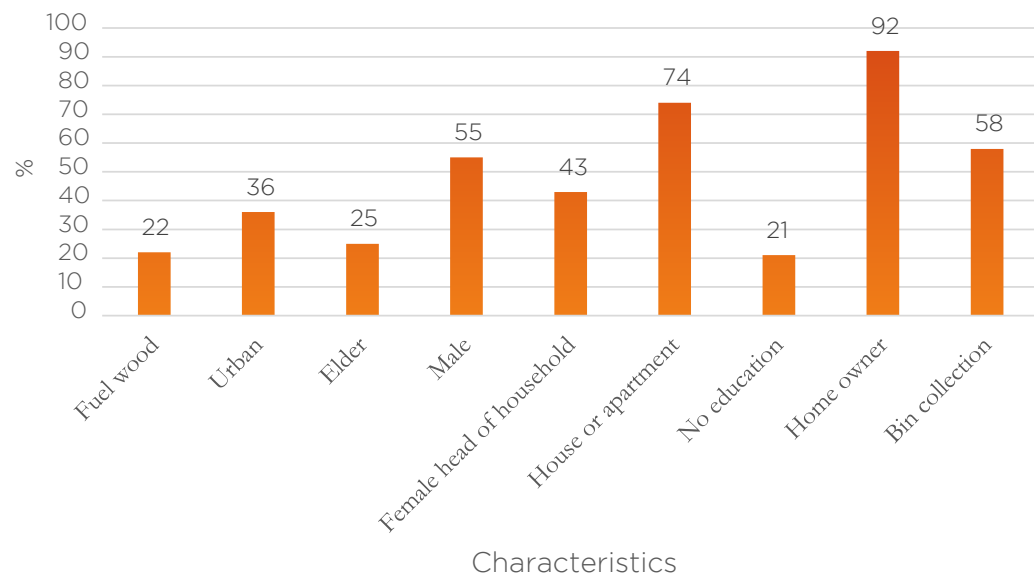


Figure 8. Characteristics of poor households in Ecuador (24,692 in total, using weights)

3.3.3.2 Differences in poor cookers

In the case of Ecuador, the characteristics of the two sub-populations of poor households that use firewood are not as heterogeneous as for Guatemala (see Appendix 2.5). The characteristics that households in one of the class groups determined by our methodology have in common are that they live in urban areas, have on average a slightly older household head, are most likely live in a house or apartment, and have a collected bins system. This is very similar to the differences in characteristics of the sub-groups of firewood users described above in the case of Peru, with the exception that in Peru the collected bins variable is absent, and that in the case of Ecuador, the variable on size was removed, meaning that we cannot make a comparison of these characteristics in particular.

The fact that the head of the household is older in the urban poor wood users' sub-group than in the rural one is not necessarily intuitive. In fact, one could expect that older generations stay in the rural areas and that younger households move to urban areas to look for employment. Urbanization is also a strong phenomenon in Latin America and the Caribbean, supporting this hypothesis. We cannot make a strong statement about why the household head of poor household that use firewood that are in urban areas is older in the cases of Peru and Ecuador. However, three hypotheses come to mind to explain why it might be the case. First, urban areas are known to have better health infrastructure and hence a better access to health services.

Second, in rural areas there is a higher use of firewood by households. As our next section on the health impacts of clean cooking shows, this has a strong negative impact on health in both the short and long terms. Finally, if in general more households use firewood in rural areas, a living zone where houses tend to be more open to one another, and where the living dwelling is less likely to be a well-isolated house or apartment, a hypothesis that is supported by Appendix 2.5, then it is likely that there is a negative spill-over effect of air pollution from one household using firewood to the neighboring households. The mechanism through which these three reasons just mentioned would affect the age of the household head is through his or her life expectancy that depends on his or her health condition.

The main characteristics that drive the two sub-populations of poor households that do not use firewood apart are the living area, whether bins are collected, and ownership. If the household is in an urban area, it is much more likely to have collected bins, but less likely to be the owner of the place (see Appendix 2.6). The fact that the collected bins' system is associated with living in an urban area is not surprising. The fact that the urban household is also one that is less likely to be the owner of the place compared to its counterpart in the rural area is more surprising. One of the reasons that might explain this characteristic has to do with rented houses or apartments using more modern equipment than owned ones, which emerged from our qualitative research that we reported in the above case study of Guatemala.

3.3.3.3 Who made the move

In Ecuador, poor households are more likely to “make the move” and transit from the use of firewood to gas or electricity if they are located in urban areas, have a younger household head, have a female household head, have less household members, the dwelling is a house or an apartment, the household head is more educated and if there is a system of bin collection (see Appendix 3.3). Most of these findings go hand in hand with evidence in the literature, except the fact that household income in the case of Ecuador seems to be less of a determinant of adoption, and the individual income not a determinant at all.

3.3.3.4 Clean Cookingness Index

The Clean Cookingness Index in Ecuador shows a very different picture from Guatemala and Peru, and from what would be expected. It is worth nonetheless recalling that in the case of Ecuador, most households use gas and have a transition from gas to electricity, and that here for comparability reasons we only focused on the transition from firewood to gas. The fitting line shows that as household income increases, the likelihood of adopting gas diminishes significantly, until reaching a specific income (that has been transformed into a logarithm here because of large numbers), after which it flattens (see Appendix 4.3). The only interpretation possible at this stage and considering the information we have on the wood to gas transition in Ecuador is that it is not income that drives this adoption, and that as household income increases for households at the very bottom of the distribution, their likelihood to transit diminishes, which could reflect that income is used for other purposes. A better understanding of this result would require a deeper analysis of this specific transition in Ecuador, which is beyond the scope of this paper.



4 WHAT ARE THE IMPACTS OF CLEAN COOKING?

When looking at the long-term dimension of clean cooking adoption, it is core to understand how the livelihoods of the users are impacted vis-a-vis those who share the same characteristics but did not switch stoves. One of the main drivers of this transition has to do with the health impacts of the adoption of clean cooking practices, which come into effect with the continuous use of cleaner cooking technologies. We start with a brief review of the literature on the health impact of clean cooking, and then zoom in into the case of Guatemala, where we could measure the quality of the air both inside and outside the household, thanks to fieldwork.

In the analysis, a clear distinction is made between the different transition phases as reported in Figure 1. As argued above, transitioning from an open fire using wood to an improved kitchen also using wood will not lead to the same results than if the transition is to LPG or electrical stoves. This is valid for both air pollution and exposure to diseases or illnesses. However, a transition from fuel wood cooking stoves to either LPG or electrical stoves will trigger benefits in terms of both air pollution and health conditions. As Rosenthal et al. find in a study on 40 developing countries, ‘under all scenarios, LPG intervention outperforms biomass stoves’ (2018:154).

Table 9 below roughly illustrates the magnitude of the impact on air pollution, health and household accidents of each cooking method. The impact can be either very negative (---), moderately negative (--), slightly negative (-), or nil (0). These estimates are based on both reviewed studies and on our own analysis. They are nonetheless to be taken with a pinch of salt, as they are only rough estimates, as each case study is different, and as conditions vary. They are useful to the extent that they allow to compare the potential reduction of harmful effects of a transition from one cooking method to another. For instance, the biggest reduction on air pollution results from the transition from fuel wood open fire pit to electrical kitchen stoves, as there is a transition from very negative effects on air pollution to none.

| | Fuel wood open fire pit | Fuel wood with manufactured improved kitchen | Gas (LPG) | Electricity |
|------------------------|----------------------------|--|-----------|-------------|
| Air pollution | (-)(-)(-) | (-)(-) | (-) | 0 |
| Health | (-)(-)(-) | (-)(-)(-) | (-) | 0 |
| Household accidents | (-)(-)(-) | (-)(-) | (-) | (-) |

Table 9. Rough estimates of different cooking methods on air pollution, health and household accidents

One of the added values of the fieldwork and data collection on air particulates in Guatemala is that accurate and precise estimates of the air quality could be measured. This allows us to close the potential information gap between what laboratory estimations of the air pollution impact of cleaner cooking stoves tell us, and what actually happens once these stoves are installed indoor. As Rosenthal et al. (2018:154) point out, '(...) while laboratory-based technology assessments and standards are useful, field measurements often suggest smaller benefits than laboratory studies both in terms of health-damaging fine particles and global warming commitment'.

This section first reviews the literature on the air pollution and consequent health impact of clean cooking. Then, it moves to the case study of Guatemala and results elaborated from the HAPIT model. Impacts of clean cooking programs in Peru are also reviewed, based on secondary sources.

4.1 Air and health impacts of clean cooking

This section looks at the air pollution and health impacts of clean cooking. The main connection between health outcomes and clean cooking programs is the relation between clean cooking initiatives and particle pollution, CO concentration in households and individual exposure to air pollution. Several studies have linked a reduction in the exposure to particle pollution on individuals to the household purchase of a more efficient stove. There is an extensive literature on respiratory health diseases being directly caused by, or indirectly more prevalent due to, the exposure to particle pollution. Deficient lung function has also been linked to households with higher indoor air pollution. Indoor air pollution from biomass fuel cookstoves is also associated with acute and chronic endothelial dysfunction. This section is divided into two sub-sections. The first looks at outcomes related to respiratory health and the second one to other health-related impacts that are not linked to respiratory issues.

4.1.1 Respiratory health outcomes

The main health issue tackled in clean cooking program is respiratory problems. There has been extensive research in this regard. A relationship between the presence of household air pollution exposure and the apparition of symptoms of respiratory diseases has been proven. For example, a deficient lung function has been linked and is prevalent, and households with higher air pollution also show increased CO and particle pollution concentration in exhaled breath (Pope et al., 2015).

Asthma is showed to have more prevalence when there is exposure to traditional and solid cooking fuel (Solis-Soto et al., 2013). Child asthma has a strong positive correlation with traditional and solid fuel exposure and has shown to decrease in households that adopt modern, cleaner stoves (Schei et al., 2004). A diminution in bronchus dilation is strongly linked with the use of open fire exposure and wood-based and biomass-based stoves (M. J. Guarnieri et al., 2014). Pneumonia has a strong positive correlation with bad ventilation in households and stove replacements for cleaner technology has shown to decrease the rates of the apparition of the disease (Smith et al., 2011).

However, mitigating measures can be taken to curtail the pernicious effects of these pollutants. Better ventilation in the kitchens, through chimneys and windows, are associated with less symptoms of respiratory diseases (Klasen et al., 2013). Additionally, the surrounding economic constraints, such as how affordable the prices of oil is, increases respiratory children's health (Venkataramani & Fried, 2011). This is something worth noting, considering oil price fluctuations, and usage of a clean cooking stove fuels. Affordability, along with the progressive attrition in the adoption of clean cooking practices of clean cooking programs can worsen the effect of the already negatively correlated to respiratory children health (Accinelli et al., 2014).

4.1.2 Other health-related outcomes

Apart from the more studied respiratory implications of having bad clean cooking practices, there are more improvements to health related to the adoption of cleaner practices. These are mainly cardiovascular. Indoor air pollution from biomass fuel cookstoves is associated with acute and chronic endothelial dysfunction (Painschab et al., 2013). Higher concentration of household pollution is also correlated with lower blood pressure (McCracken et al., 2007; Young et al., 2019) and smaller dilatation of the artery (McCracken et al., 2011; Miele et al., 2015). Additionally, there is a strong relationship between the use of traditional cookstoves and solid fuel with ST-segment depression and increase heart rate variability (Pollard et al., 2014; Thompson et al., 2014). Cardiovascular diseases being the leading cause of deaths in the world allows us to surmise the positive impact that clean cooking programs could create, as their application would improve cardiovascular outcomes, thus potentially lowering mortality.

Another health outcome of note associated with clean cooking is lower baby weight in pregnancy and after birth in relation to pollution particle exposure (Thompson et al., 2011). Higher infant mortality is also related to the use of open fires, traditional stoves and solid fuel (Rinne et al., 2007). This is relevant, as child mortality is cut in half if a clean cooking program is adopted in a community. Usage of modern stoves in clean cooking programs and the attrition regularly inherent of such programs is related to less and lower quality sleeping (Accinelli et al., 2014). Lower quantity of hours sleeping is related to a number of diseases, such as a higher chance of cardiovascular morbidity. Eye health condition, irritability and red eyes are also found to be correlated with the use of “plancha”-style stoves use in often poorly ventilated households (Diaz et al., 2007). The red eyes and their inflammation is a consequence of using non-improved cooking stoves that were also reported in our semi-structured interviews in Guatemala.

Some health benefits that clean cooking programs provide are however not related to smoke and CO exposure. There is an impact on general health costs, as clean cooking has a strong positive correlation with the reduction of medical clinic visits (Harris et al., 2011). This is noteworthy, as it enables households to save relatively high amounts of money, cut healthcare costs, and decongest provision of healthcare, thereby increasing the health system's efficiency. The combination of educational classes and the replacement of the stove in a clean cooking program has been proved to reduce the amount of E.Coli concentration in the kitchen, sink and food, reducing related diseases (Hartinger et al., 2011). The reduction of reported headaches and backpains are significantly correlated to the presence of a “plancha”-style cooking stove after the intervention of a clean cooking program (Diaz et al., 2007). The “plancha”- style cooking stoves use is also related to a higher self-perception of health, linking clean cooking programs with improvements in general health outcomes, and as a selling point to prevent attrition in individuals (Diaz et al., 2008). This enables to improve the acceptance and trust of the program once implemented.

Although the medical literature has focused heavily on the health outcomes that cleaning cooking programs have, there also exists analysis on the efficacy of clean cooking programs. One of the main focuses of the literature is on the difference between the short run and the long run shocks of the intervention (M. Guarnieri et al., 2015). As short run interventions are proved to be of little effect and of low efficiency, in the adoption of new habits, there is a need to maximize the effect of the clean cooking intervention and prolong the programs through time. This would allow to increase the benefits for the population. As an example, installing chimneys on kitchens will reduce the amount of pollution in kitchens, decreasing the amount of pollution breathed in and improve respiratory health in the households that use them.

From this section, we can extract that cleaning cooking programs are related to the improvement of several health outcomes, mainly respiratory health, as well as cardiovascular health, eye health, general health and that it is related to a reduction in infant mortality.

4.2 Case studies

This section looks at only two of our case studies (i.e. Guatemala and Peru) to provide some insights on the potential health and air pollution impacts of clean cooking stoves programs in each of them. For Guatemala, we use results from the fieldwork carried out before, during and after the mission, using the HAPIT model and data collected locally. For Peru, we rely on the existing studies and literature. We look at a program where the implementation has been consummated with the goal of replacing wood stoves for LPG or improved wood cookstoves. The program was carried out by EnDev and the GIZ cooperation program. Ecuador could not be covered in this section due to a lack of information and studies on the health and air pollution impacts of clean cooking in the country. This is not surprising, as the percentage of the population that uses fuel wood for cooking is also considerably lower than in Guatemala and Peru.

4.2.1 Guatemala

To estimate the impact of health-related benefits on the livelihoods of the implemented populations, measurements of exposure to pollutants and particulate matter in the highlands of Guatemala were carried out. The population of several villages who will soon be targeted by the intervention was studied to gain insight into how the exposure to PM_{2.5} they are subject to impacts their lifespan and the amount of years spent living with a respiratory related disability.

The model uses localized estimates of the country and specific variables of the program to calculate and give those estimates within a range. Then, these are compared to WHO and IHME data on the effect of exposure over the long run on health, linked to the presence of different respiratory related sicknesses in the users exposed to particular levels of PM_{2.5} particulate matter.

These specific particles distribute themselves across the available height for the gas to expand, since they are heavier than other emissions, such as CO₂. They are more concentrated in layers closer to the ground under conditions of stationary air flow. Therefore, those with smaller heights tend to be exposed to significantly higher levels of these particles relative to the time they spend in the kitchen, despite not being as involved in cooking. Because of this, children suffer a relatively higher impact, since they are usually the shortest of the households.

One of the core concerns of most implemented programs of clean cooking is to achieve an improvement in the exposure to pollutants. Cookstoves based on fossil fuels have systematically higher emissions in terms of gases, particulate matters and other pollutants that can induce the aforementioned chronic diseases, as well as a plethora of other afflictions. These gases might lead to reduced lifespans for the users.

While the amount of emissions from the cookstove is indeed dependent on the fuel used, the surrounding characteristics of the room where cooking happens critically determines the exposure of the dwellers. Some of these characteristics are related to the cookstove, such as the insulation of the burning chamber or the existence of a chimney with which the gasses from combustion can be exhausted completely and led to the outside. Others are the number of windows in the room, having a different space for cooking and sleeping, or practices such as cooking outside, help reduce the pernicious health effect of individual exposure.

In all the above cases, the characteristics of the dwelling tend to be closely intertwined with tradition, as well as thermal and meteorological conditions. We therefore tend to find similar problems clustered in the same group of communities. In areas where there are heavy rains, the practice of cooking outside is consequently diminished, whereas in very dry and hot areas the need to create air drafts inside the house might lead to better ventilation.

However, it is not only the attributes of the household that change the exposure. The type of fossil fuels has remarkably different levels of emissions and therefore remarkably different effects on exposure. While LPG has lower emissions both in gases and PM 2.5, wood tends to have much larger ones in both for the same amount of energy extracted. The type of wood used makes a further difference on emissions; with lower energy output and higher emissions for wet wood relative to dry wood, as well as the inherent emission to the different plant from which the wood is sourced.

Based on the previous factors, an outcome exposure to pollutants in a kitchen arises. Our interest is based on this outcome, which is estimated from health exposure data. These allow us to measure the health effects of having a given type of kitchen, using a given type of fuel, and following certain practices can have on the overall health of the potential beneficiary population of a clean cooking program.

To establish this outcome exposure, a researcher on the field in Guatemala took measurements of users of different types of kitchen on the relevant variables of emissions. Data on PM2.5 and CO on a 60 measures-an-hour frequency for personal exposure were taken during the field intervention and with a lower registering sensitivity bound of 10 micrograms per cubic meter. Additionally, stationary measurements in the kitchen were gathered, indicating the CO2, temperature and relative humidity. All the samples have attributable data on the height, location of the household, which along with variables included in the KPT Survey in the annex, allow us to typify the characteristics of the households.

To avoid misinterpreting the exposure to the pollutants, all measures were taken in 24h-periods outside of local festivities, as to capture the regular exposure to the pollutants. Therefore, higher or lower measurements during Christmas and other celebrations that might involve heavier cooking loads or changes in normal daily recurrent behavior were avoided. The measurements were taken using PATS+ produced by the Berkeley Air Institute with all of them being zeroed-out during at least 20 minutes and CO2 Meter instruments zeroed out according to the manufacturer specifications.

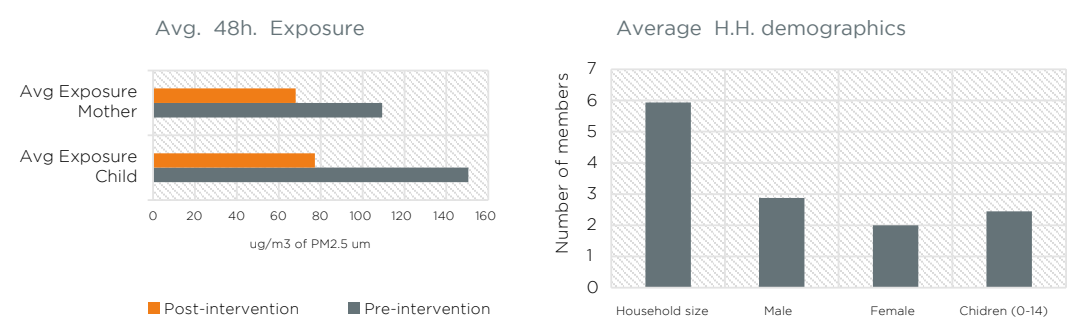
The data gathered was specifically collected from households located in the villages of Chocavioc, Cantel, Tierra Colorada Alta and San Mateo in the region of Xela, in San Jose in the region of Poaquil and in Chimalenango. The personal exposure monitors were placed when possible on the chest of the cooker of the house (which we found to be predominantly the women) and on one of the children to use as a measure of prominently non-cooking adults. When available, one extra monitor was positioned as an ambient control of the area for the day.

For the evaluation of the data, the clean cooking intervention tool known as the HAPIT model was selected, as it permits to put the samples observed in the context of previous studies on personal exposure and obtain the embitterment of the health outcomes for a given level of exposure. It allows to create and evaluate the overall effect of different exposures resulting from the adoption of different types of kitchen.

The tool is based on indoor pollution studies done by the World Health Organization and the change in health outcomes for a given change in the exposure level. It was designed at Berkely University to serve as a tool to evaluate the health-related cost-benefit analysis of different clean cooking interventions, and allows to put into a reference scale the importance of these type of programs and the gravity of the problem of the use of dirty fuels inside households.

Based on the evaluated householder, we find that mothers in households with improved stoves were on average exposed to 68.06 ug/m³, while kids were exposed to an average of 77.23 ug/m³ (Figure 9). Those were on average large, with almost 5.94 members on average for the whole sample. Those without intervention reported an estimate of 109.39 and 150.48

ug/m3 for mother and child, respectively. For post-interventions, we found relatively small standard deviation with 62.8 and 96.94 ug/m3, again, respectively for mother and child. This points to different effectiveness due to misuse. The numbers explicitly show the difference in exposure to PM2.5 depending on the type of cooking stove used inside the household.



Figures 9. Average PM2.5um exposure according to gender and age

HAPIT assesses the cost-effectiveness per averted DALY (disability-adjusted life year) using the WHO’s proposed CHOICE methodology. The reported results follow the average conditions in Guatemala (such as the number of members of the household, background disease levels, or income¹⁴). More details on the HAPIT model can be found in Pillarisetti et al. (2016).

Approximations obtained in the model are founded on methods proposed in the Comparative Risk Assessment for the IHME Global Burden of Disease project with evidence from GBD-2013 along exposure and effect data for diseases in the country related to Household Air Pollution and background health, demography, fuel use and output, and other economic related conditions.

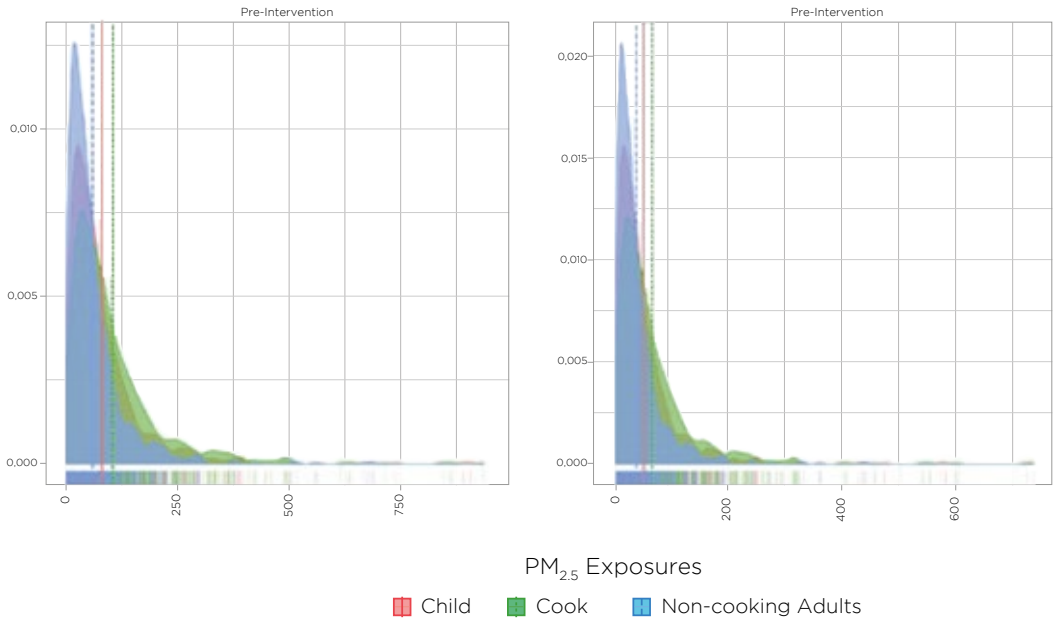


Figure 10. Estimated distribution of exposure according to the HAPIT model Calibrated on Field gathered data

14. A more specific list can be found in the model documentation from: <https://householdenergy.shinyapps.io/hapit3/>.

Following the recently proposed NAMA project in Guatemala, we evaluated the impact of the intervention on 250,000 homes, with a conservative level of adoption of 80%, and a life without repairs for the stove of 5 years. Figure 10 shows the calibrated data, or amount of adults in the household.

Based on the calibrated inputs of the model, Figure 11 below shows the averted diminished health on various degrees. It is contrasted against the counterfactual of a perfect intervention where adoption would reach a 100 percent of sustained penetration in the target population, to a level of 7 ug/m³ of PM_{2.5} um, which would be slightly below the threshold level to non-health impact of PM_{2.5} set by the WHO and the EPA (at 10 and 12 ug/m³), respectively.

This level follows the conservative estimate of the Burden of disease study of 2010, which set it at 7.3 ug/m³. Due to the exponential nature of exposure to PM_{2.5} in human health, we can see large avertable numbers, since there is a fast-growing marginal effect for every increased ug/m³ of exposure reduced by the intervention. This highlights the importance of clean cooking interventions. It is framed on the difficult tradeoff between achieving a high-effect intervention, since the adoption of different types of kitchens must ponder whether to be incremental to foster the overall adoption, and risking some of the systemic infrastructural and logistic challenges of transitioning to LPG and electricity-based stoves (namely quality and access to electricity or efficiency of logistic network to deliver LPG).

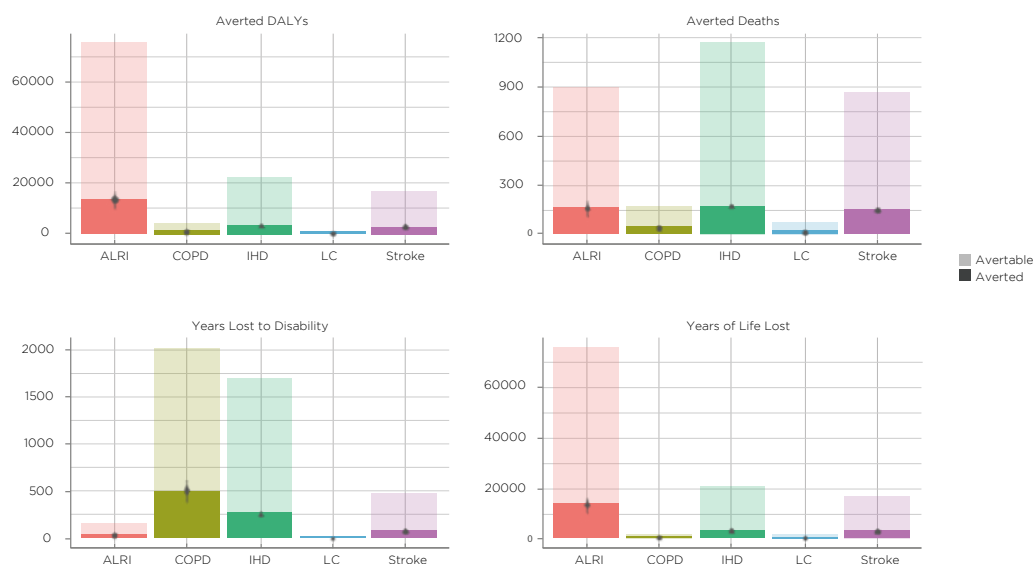


Figure 11. Avoidance of ill effects on health due to the intervention

Using background data, the HAPIT estimates the effect related to Lung Cancer (LC); Ischemic Heart Disease (IHD); Stroke; Acute Lower Respiratory Infection (ALRI) in those aged 0-4; and Chronic Obstructive Pulmonary Disease (COPD). These calculations are done on the basis of the integrated exposure response (IER) function with data created by IHME and using pre- and post-intervention relative attributable causation of PM_{2.5} exposure to each disease (Tables 10 and 11).

| Cause | Measure | Age | Mean Averted | Min Averted | Max Averted | Total Avoidable | Percent Avoided |
|--------|--------------------------|-------|--------------|-------------|-------------|-----------------|-----------------|
| ALRI | Averted DALYs | Child | 13669 | 9145 | 16702 | 76013 | 18% |
| ALRI | Averted Deaths | Child | 159 | 106 | 195 | 886 | 18% |
| ALRI | Years Lost to Disability | Child | 30 | 20 | 36 | 166 | 18% |
| ALRI | Years of Life Lost | Child | 13640 | 9125 | 16666 | 75847 | 18% |
| COPD | Averted DALYs | Adult | 1127 | 729 | 1432 | 4554 | 25% |
| COPD | Averted Deaths | Adult | 41 | 27 | 52 | 166 | 25% |
| COPD | Years Lost to Disability | Adult | 502 | 325 | 638 | 2028 | 25% |
| COPD | Years of Life Lost | Adult | 625 | 404 | 794 | 2525 | 25% |
| IHD | Averted DALYs | Adult | 3332 | 2270 | 5960 | 22594 | 15% |
| IHD | Averted Deaths | Adult | 173 | 118 | 309 | 1172 | 15% |
| IHD | Years Lost to Disability | Adult | 250 | 171 | 448 | 1698 | 15% |
| IHD | Years of Life Lost | Adult | 3082 | 2100 | 5512 | 20896 | 15% |
| LC | Averted DALYs | Adult | 372 | 190 | 445 | 1480 | 25% |
| LC | Averted Deaths | Adult | 18 | 9 | 21 | 70 | 26% |
| LC | Years Lost to Disability | Adult | 4 | 2 | 5 | 16 | 24% |
| LC | Years of Life Lost | Adult | 368 | 188 | 440 | 1463 | 25% |
| Stroke | Averted DALYs | Adult | 2854 | 878 | 3547 | 17085 | 17% |
| Stroke | Averted Deaths | Adult | 143 | 44 | 178 | 857 | 17% |
| Stroke | Years Lost to Disability | Adult | 80 | 25 | 99 | 476 | 17% |
| Stroke | Years of Life Lost | Adult | 2774 | 854 | 3448 | 16610 | 17% |

Tabla 10. DALY's, Deaths , YLD's, and YLL's averted by the proposed intervention by age group and disease

| Measure | Age | Mean Averted | Min Averted | Max Averted |
|----------------|-------|--------------|-------------|-------------|
| Averted DALYs | Child | 13669 | 9145 | 16702 |
| Averted Deaths | Child | 159 | 106 | 195 |
| Averted DALYs | Adult | 7685 | 4067 | 11384 |
| Averted Deaths | Adult | 375 | 198 | 560 |

Tables 11. Total DALY's, Deaths , YLD's, and YLL's averted by the proposed intervention by age group and disease predicted by the HAPIT model

4.2.2 Peru

This section summarizes the main results identified in the literature on improved kitchens in Peru. Information used is from secondary sources, which include the review of academic literature and documentation prepared by the relevant institutions. It is worth mentioning that the Ministry of Energy and Mines of Peru (MINEM) and the German Cooperation (GIZ) allegedly do not have detailed evaluations or reports on the programs of clean cooking they have overseen. To such extent, this section has been developed resorting only to information available in the public domain and which could be verified.

The harmful effects on homes that use traditional kitchens are known both nationally and internationally, especially for their impact on the health of family mothers and daughters, who are always present during the cooking process. In this sense, the adoption of improved kitchens represents an important cost-benefit for households, while reducing pollution at their homes and reducing health costs. Specifically, for the Peruvian case, Silva & Zeña (2007) and INEI (2019) depict very well the health effects of exposure to smoke generated by traditional kitchens with a focus on rural areas and on poverty. An improved kitchen has components that increase its energy efficiency and reduce pollutants. It is a technology that consists of a combustion chamber and chimney with chapels to extract smoke from the house (GIZ & PCM, 2011).

Households with improved kitchens in Peru showed improvements in the family's health, mainly in mothers' and younger daughters'. In the evaluation of the impact of the kitchens installed in the framework of the Improved Kitchens campaign, IPSOS (2012) identified important advances in the health of families that transitioned to an improved kitchen, estimating a Health Improvement Indicator of 97.2%. That is, in almost all households there is improvement in health, with a form of disease in any of the members. Specifically, sight infection, lung diseases and muscle aches - conditions linked to the use of traditional cooking or cooking stoves - decreased dramatically and reduced health conditions in both mothers and daughters who mainly operate in the kitchen. For example, with improved stoves, cough diseases were reduced by 30%, vision infections by 29% and back pain borne by mothers was reduced by 54%.

By contrast, for the Haku Wiñay program, Escobal et al. (2016) point out that, although the prevalence of respiratory and stomach diseases in beneficiary households was reduced, to the extent that the control group also shows improvements in these areas, there is no clear evidence that allows to attribute this improvement exclusively to the intervention. Nonetheless, the authors did identify other positive health practices attributable to the program, thanks to best practices in handwashing.

In the study conducted by Zeña (2014) about perceptions of rural women and their performance with improved kitchens, the health conditions of women improved, mainly in ocular discomfort, cough and flu, although they perceive in a limited way the link between low smoke and improvement in problems of health linked to the benefits of improved kitchens. The motivations of women to use these kitchens were mostly related to saving time and firewood. In this regard, the author indicates that the implementation of projects on improved kitchens should include topics on training and good health practices to be an efficient and participatory health project.

Households that have improved kitchens significantly reduce pollution inside the home and the presence of toxic elements in the human body. In the study conducted by Fitzgerald et al. (2011) for a sample of households with the intervention of the “Improved Kitchens” Program of the MINSA, the authors identified a significant reduction in personal exposure and concentrations in the kitchen of fine particles and carbon monoxide (CO), reporting reductions of 70% and 41%, respectively, in 48 hours. These results are consistent with percentage reductions seen in other studies of stove interventions around the world. Kitchen area and personal CO exposures were reduced at levels on the high end of what is reported in the literature.



5 PRE- AND POST-ADOPTION BARRIERS OF CLEAN COOKING PROGRAMS

This section is divided into two: pre- and post-adoption barriers to clean cooking stoves programs. The reason is that evidence reveals that despite households overcoming the pre-adoption barriers and implementing the clean cooking stoves program, some households still drop out of the program in the long term- a phenomenon we have been referring to as attrition. We first review pre-adoption and then post-adoption barriers. In some instances, one barrier might overlap between both pre- and post-adoption phases. Suggestions on how to overcome these barriers are left for section 6 on policy recommendations.

5.1 Pre-adoption barriers

Historically, clean cooking stoves programs have struggled to be adopted in low income households and rural communities. All countries that have taken part in clean cooking programs report lower adherence of the program in rural and poorer communities. There are several reasons that explain this low adoption, which we consider as barriers to adoption, and which range from infrastructure barriers to preferences of the local communities. These different “pre-adoption” barriers faced by low income and rural households to adopt clean cooking stoves can be organized under four headings: socioeconomic, informational, infrastructural and financial. We review each of these in details. This section only considers barriers that exist before the households actually start using the clean cooking stoves. The dichotomy between the pre- and post-adoption barriers is useful to the extent that for policy-making it can inform the timing of the policies, as in whether they should be well-anticipated ahead of the program implementation, or if they should come in at a later stage and depending on the evolution of some conditions.

5.1.1 Socioeconomic barriers

One of the big reasons for the failure of adoption of clean cooking stoves are socioeconomic variables, as was shown by the FISE program (Pollard et al., 2018). As Kozulj notes, a greater per capita firewood consumption is generally associated to low Human Development Indices (2009). Poor, rural and indigenous households tend to be the ones facing the highest barriers to adopt clean cooking habits (Gould et al., 2018). This is best reflected in the strong correlation

between income and social status favoring adoption of clean cooking programs, as shown in several studies (Lewis & Pattanayak, 2012; Gould et al., 2018). Conversely, urban population is also more likely to adopt clean cooking interventions (Lewis & Pattanayak, 2012). Efforts should therefore be put into defining the specific characteristics of rural dwellers.

Intra-household gender dynamics play a significant role in the adoption of clean cooking stoves. Disparity between male and female education is negatively associated with the adoption of clean cooking stoves. This is due to the lower negotiation power of women inside the households, as women with low education tend to spend more time in the household and not partake in the labor market, or if they do, they have lower income jobs (Lewis & Pattanayak, 2012). According to the literature, this effect is further increased with the age of the dwellers, with older people being usually more reluctant to adopt new habits (Wolf et al., 2017). It is worth noting that on the contrary to what the literature states, our empirical analysis above suggests that the elderly are more likely to adopt clean cooking, which also emerged from our semi-structured interviews in Guatemala. As mentioned previously, this could be due to higher awareness of the health impact caused by non-improved cooking stoves, or to higher financial resources that make improved stoves more affordable. These contradictory findings reiterate the importance of a tailored approach to clean cooking programs.

A higher educational attainment of any of the members of the household induces higher adoption of cleaner stoves, with this effect being stronger for women (Wolf et al., 2017). From a purely gender-oriented perspective on the decision to adopt the new technology, men are usually the ones who carry out the purchase (Debbi et al., 2014). If the negotiation for the adoption is however influenced by the wife or mothers-in-law, their opposition can be a potential deterrent to the purchase (Ibid).

Whereas the literature finds that house ownership is an enabler of adoption of modern stoves, as kitchens are a part of the household, and improvements to the household are considered a positive investment, on top of the more obvious link to higher income (Rehfuess et al., 2014), our empirical analysis suggests the contrary. This is due to the fact that rented houses would allegedly be more invested in and equipped with more modern appliances, including cooking stoves.

The number of household members also matters and drives the likelihood of adoption up, as larger households (i.e. 5 to 10 members) require longer cooking preparation time, which can be reduced with modern cooking stoves (Lewis & Pattanayak, 2012). Paradoxically, the existence of larger families that live outside the household can be a deterrent to adoption due to occasional greater need of cooking (i.e. for 11+ persons), which clean cooking stoves are not usually designed for (Rehfuess et al., 2014). This opposite effect depends on the temporality of cooking, as households are more inclined to adopt the stove if the efficiency is something that is of need on a daily basis, but not if it is a need that is occasional.

5.1.2 Informational barriers

Lack of information is one of the biggest barriers to clean cooking stoves adoption, as reported in the literature. It is perceived to be the area with the biggest potential for improvement. Previous knowledge of the program largely affected adoption for the FISE program (Pollard et al., 2018). In the negotiation process of adoption, short-term health outcomes are strongly considered by the decision-makers of the household, but there is a lack of promotion of these. Examples of these outcomes are burn reduction (Rehfuess et al., 2014), less respiratory symptoms, headaches, sore throats, sore eyes, and need for less healthcare (Debbi et al., 2014), to cite a few.

In spite of all these benefits, health improvements are not usually considered a convincing entry point and motivator to foster and strengthen adoption (Hartinger et al., 2011). This might nonetheless be because of a lack of information (Hollada et al., 2017). Conversely,

safety issues, such as skin burns and household fires, in relation to wood, create a strong incentive for adoption (Debbi et al., 2014; Rehfuess et al., 2014).

To induce demand for a stove, the individuals' perception of the stove plays an important role. If individuals have a positive perception of the program, they are more likely to purchase it. In the analyzed countries, a key determinant for individual perception derives from the community perception, so it is better for clean cooking stoves programs to target the community as whole. Perception of a social status gain when purchasing a stove, a stove being a symbol of wealth, is a motivator for adoption (Puzzolo et al., 2016). If the stove promoted in the clean cooking programs is related to a higher social status, it becomes a value in itself, thereby prompting adoption (Debbi et al., 2014).

The opinion of the local leaders is a strong influencer of uptake. It is reported that in Latin America, local leaders usually support this initiative, therefore there is not much margin of improvement in this area (Rehfuess et al., 2014). In some communities, fuel gathering is done at no cost and is considered an activity to be performed with the family. For those communities, the implementation of programs that switch to cleaner fuels becomes more difficult, since the cost of wood is perceived as zero, meanwhile the cost of the replacement fuel, such as LPG, is not profitable to the users when making the transition (Debbi et al., 2014; Rehfuess et al., 2014; Thompson et al., 2018). This is more likely to happen in rural areas. The support of the government facilitates the labor of the program, indirectly increasing the perception of trust in the programs and directly with policies (Rehfuess et al., 2014).

The community's involvement in the clean cooking program through instructors and supporters increases adoption considerably (Rehfuess et al., 2014). General lack of knowledge about the safe use of the modern cookstoves, and fear of explosions of oil-based and LPG cookstoves, are considerable impediments to adoption. However, with the help of gossip that spreads the message, its appearance seems pervasive and prevalent to fuel switching programs (Hollada et al., 2017; Puzzolo et al., 2016). Countering the negative effect of the misinformation on the functioning of the stoves, we find that the diffusion of real life experiences from neighbors is a big barrier for adoption if negative, and a big catalyst if positive (Debbi et al., 2014). This finding was also salient in our qualitative data collection in Guatemala.

Good marketing campaigns of the clean cooking programs play an enormous role in the adoption (Puzzolo et al., 2016). Examples of effective ones are demonstrations in local markets and media signaling of the technology. New technology is better perceived and more easily adopted if it is presented comparatively to what the old technology was lacking (Thompson et al., 2018).

5.1.3 Infrastructural barriers

Depending on the program being implemented, specific infrastructure is required for successful adoption. The particular fuels and technologies used in the replacement stoves depend on the infrastructure's well-functioning, thus making the adequacy of the intervened community's infrastructure a fundamental prerequisite for the success of the program. The most effective solution however remains the source of high expenses. Electricity and water access are necessary conditions for adoption. Water access to the household is necessary, as clean cooking programs need water to perform the cleaning behaviors needed. Electricity access is also a strong predictor of uptake, as several stoves need electricity to work (Lewis & Pattanayak, 2012; Pollard et al., 2018). Finally, one of the most impactful policies the government could implement in order to significantly increase the adoption of clean cooking stoves is the construction of access roads that would create a better supply of fuel, so that supply trucks can access the area easily (Rehfuess et al., 2014). Infrastructure requirements linked to access roads are particularly relevant for the transportation of clean fuel tanks, such as LPG (Rosenthal, 2018).

5.1.4 Financial barriers

Financial issues related to price costs appear to affect the possibilities of the program adoption greatly (Rosenthal, 2018; Troncoso and Soares da Silva, 2017). Stove adoption is usually a costly technology for a household, and so the decision making surrounding it as described above is complex. What we know is that credit access benefits greatly the initial adoption of the technology, but that capacity to save money is a strong motivator for clean cookstove adoption (Debbi et al., 2014; Lewis & Pattanayak, 2012). Usually households prefer to make a single payment instead of making multiple smaller payments that impose a higher upfront cost (Debbi et al., 2014). This is a restriction that has remained despite the plurality of credit facilities sometimes associated to this program. It makes those out of the labor market and on the lower deciles of income stay away from clean cooking programs (Debbi et al., 2014; Pollard et al., 2018; Puzzolo et al., 2016).

When potential users are pondering adoption, they are motivated by the tightness of their household budgets. They are prone to go down the road of fuel cost reduction when deciding to switch to a new type of stove and adopt them more whenever the savings are significant or accompanied by any other cost reduction for the household (Debbi et al., 2014; Puzzolo et al., 2016). Countering fuel savings, the price volatility in fuels mitigates the adoption, making attrition and the return to the old fuels likely (Puzzolo et al., 2016). This has been specifically studied for the fluctuation of the price of oil, with higher volatility resulting in a diminution of the likelihood of adoption and increases in attrition for those who already had adopted the programs with oil fuel use (Venkataramani & Fried, 2011).

The implementation of subsidies to ease the switch between stoves is a somewhat common practice across different programs. It can support both the fuel and the stove itself, as well as the different equipment associated with operating the stove. The implementation of a full subsidy covering the total cost of the stove has been studied. Evidence reveals that making the clean cooking stove a donation diminishes its value in the eyes of the decision makers and the community at large. It is of high importance that the subsidy does not blur the potential user's perception of the stoves as being a high value utility (Debbi et al., 2014). In the same spirit, larger subsidies devalue the intervention, meanwhile smaller subsidies incentivize uptake more fervently (Rehfuess et al., 2014). The existence of a subsidy of any kind is a strong catalyst for adoption (Puzzolo et al., 2016). All these findings seem to indicate that the demand for the stoves relative to the subsidy follow an inverse gamma distribution. Nevertheless, as was described in Section 2, subsidies are not a necessary policy for successful clean cooking programs, and have a high fiscal cost, harmful effect on competitiveness and worsening impact on income inequality by benefiting the high income-households, amongst others.

5.1.5 Institutional barriers

One additional pre-adoption barrier that is not directly related to the consumers has to do with the institutional context in which the clean cooking program takes place. In a study assessing a clean cooking transition policy in the Chilean Southern city of Temuco, Boso et al. (2017) note that this is an important factor. Temuco, along with other mid-sized cities in Southern Chile, are exceptions of cities where households use wood as fuel, as these are usually located in rural areas, as mentioned previously (UNEP, 2002).

Through a sociological lens, the authors carry out semi-structured interviews with key stakeholders and exercises based on participant observation. Based on these, they find that coordination issues between different regulating institutions, as well as power asymmetries, impact the settling of the necessary external conditions needed for households to adopt alternative technologies to the cooking stoves that rely on wood (Boso et al., 2017). One example they cite in the context of a lack of coordination is that of policies that overlap and are inter-dependent, including in the success of their outcome. In the case of Temuco, the stove replacement policy, that for the thermal reconditioning of the house and that on the restriction of the use of traditional stoves that require wood illustrate this example.

Power asymmetries, in the case of Temuco, arise between the governmental institutions and some local manufacturers. On the one hand, local authorities and the industry of pellet support a transition through a pellet stove, as it promotes the use of biomass, which is perceived as a clean fuel that belongs to the region. On the other hand, some of these initiatives are being blocked by other powers that support producers and providers of alternative technologies or fuels, such as those involved in the production, sale and distribution of firewood, amongst others (Boso et al., 2017).

To sum up, pre-adoption barriers to clean cooking stoves adoption can be classified into either socioeconomic, informational, infrastructural, financial or institutional. The socioeconomic barriers have to do with income, living zone, education, gender, age, home ownership and the number of family members. Informational barriers are linked to information on health, safety, infant mortality and perception of the clean cooking stoves, that depends on local leaders, the community and gossip. In terms of infrastructure, the main elements are electricity, water and roads for transportation. Financial barriers relate to the type of payment that can be made, access to credit, the price of fuel and the coverage of the subsidy. Finally, institutional barriers are about a lack of coordination and power asymmetries, amongst others.

5.2 Post-adoption barriers

The post-adoption phase faces different barriers than the pre-adoption one in low-income households, i.e. adherence can be motivated thanks to collaboration with local masons and be deterred greatly by water availability at a later stage (Hartinger et al., 2011; Puzzolo et al., 2016). The post-adoption phase is basically the 'long-term' adoption of the clean cooking stoves. This means that it does not just look at the first or first few times the household uses the modern cooking stoves, i.e. the adoption phase, but rather whether the household continues to use it in the long-term, and hence during the 'post-adoption' phase. The range of issues concerning post-adoption is wide. We have organized them into five groups: financial, cultural and traditional, socioeconomic and community-based. Some of them overlap with the pre-adoption barriers.

5.2.1 Financial barriers

Costs are the main reason for attrition. Maintenance and fuel costs play a great role in the long-term use of the clean cooking kitchens. For example, higher maintenance cost for a higher cost of fuel is a deterrent in long-term adoption, as variable costs are more important for households. They have a direct impact on savings. On the contrary, low maintenance costs create a strong incentive for adoption (Rehfuess et al., 2014). Nonetheless, for homes that perceive cooking as more time efficient following the adoption of the modern stoves, the resiliency to move back to traditional cooking practices is higher (Rehfuess et al., 2014). In addition, the sustained use of modern fuels is hampered by the seasonal availability of wood and lack of trust in fuel retailers (Thompson et al., 2018).

5.2.2 Cultural and traditional barriers

One of the main caveats of the post-adoption phase, i.e. "long-term" adoption, of cleaning cooking habits deal with cultural preferences (Kozulj, 2009), as well as tradition and habits (Boso et al., 2017). For instance, with certain types of clean cooking technologies, such as LPG, households may have some safety concerns that discourage them from buying ICS, as emerged in a study conducted in Peru. The in-depth interviews carried out by Rhodes et al. (2014) in Peru show that for women it is important to continue to use traditional stoves to maintain traditional food preparation practices, which are considered relevant components of cultural identity. This was also found in the study by Hollada et al. (2017) that assessed the success of clean cooking practices in Peru.

Some households have noted deficiencies in the product design of clean cooking stoves to adapt to local lifestyles. As an example, the inability for the planchas and cookstoves to heat a room has been reported as a reason for attrition, alongside a deterrent for adoption. In some cases, it also explains why there is a coexistence between modern stoves and old technology in households, a practice that becomes more prevalent in colder areas (Debbi et al., 2014; Diaz et al., 2008; Gould et al., 2018; Rehfuess et al., 2014). The time required to cut the wood into pieces for the plancha style stove is another known deterrent for its continued use (Diaz et al., 2008).

Community-based customs and traditions regarding cooking practices are the cornerstone of the user experience. The perceived quality of the stove when put to use is a strong reason to adopt it in the short term. Plancha-style stove interventions in general have shown to have more caveats than others, as their inability to produce light, in order to illuminate a room, was found to be a main concern of the household members (Diaz et al., 2008). Additionally, the inability to burn leaves or agricultural residues in the cookstove prevents adoption in communities that do this on occasion (Debbi et al., 2014).

In some communities, the preference for a strong fire has led to stove designs with two or three mouths of fire, in order to make them more likely to be adopted, as this is perceived as a strong advantage of the cookstove (Debbi et al., 2014). The adduced motive behind this is the perception of a faster cooking experience. In the same line of thought, there is preference for the perceived time gain as a result of the new stove (Puzzolo et al., 2016). The surrounding equipment necessary for cooking in the new stove is an additional transition in the kitchen habits.

The inability to use clay pots in clean cooking stoves is positively correlated with attrition, as households largely use clay pots, and lots of them consider clay pots to be economically efficient as they can be homemade at zero cost (Diaz et al., 2008). Therefore, it is of extreme importance that stoves enable the use of large clay pots in communities that use them, as well as in communities where families are large or its visits frequent, meaning that needs to cook in large quantities arise (Debbi et al., 2014). Many clean cooking kitchens may not be habilitated for this, forcing households to go back to the use of their traditional methods. Related to this, the inability to cook traditional food in the modern stoves is the strongest motivator for attrition, as people desire to be able to eat their traditional diet and are strongly resistant to change that habit (Debbi et al., 2014; Gould et al., 2018; Rehfuess et al., 2014). One other factor that has been found in the literature has to do with the taste of food in traditional cooking methods (Hollada et al., 2017; Puzzolo et al., 2016), which is the crux to adapt the design of the stove to the local diet. Some households have been more reluctant to adopt the clean cooking stoves, as they noticed that the food tasted differently when they used it, compared to their more traditional way of preparing and cooking food.

In addition, the user-stated difficulty of cooking animal food is also an inconvenience of clean cooking stoves, though minor (Diaz et al., 2008). Difficulties in cleaning compared to the traditional stoves are noted to diminish the preference of potential users and tied with a higher frequency in the need for maintenance of the modern cookstove has a strong correlation with attrition. (Debbi et al., 2014) Durability of the stove is a key component. These are perceived as high-quality stoves if they are durable and users will promote those stoves to acquaintances and persevere in the use themselves.

Some of the design objectives of the stoves can also counter the community's intuition. One example of this is the goal of reducing the smoke inside the household due to its pernicious effects that clean cooking stoves integrate into their designs. However, the reduction of smoke that the use of some more modern stoves lead to is perceived by some communities as a detriment to the effectiveness of the stove in the long run, since the smoke produced by the traditional stoves acted as means against insect, and more specifically mosquitoes (Debbi et al., 2014).

Finally, Boso et al. (2017) make the point of the change of “ecological practices”, by which they imply changes in tradition and habits. In the South of Chile, the transition to pellet stoves requires not just reconfiguring heating and cooking practices, but also social ones, as the wood stove would create a common space around which family members gather. It also evokes the warmth of home and the heat it releases creates a feeling of homeliness (2017:10). Another point has to do with the household tasks that are traditionally realized with the wood stove, such as the cleaning and drying of clothes, and hence its perceived capacity to perform multiple tasks. Finally, the wood stove has been present for decades and across generations in the South of Chile, and hence its use is something that is learnt from an early age and where knowledge can be transferred across generations. The authors report that users of the traditional wood stove speak of a ‘historical knowledge’ of the handling of the wood, that goes from the selection of its type to the cleaning and maintenance of the stove in all seasons of the year (Ibid.). By contrast, the new pellet stoves and its usage are new for all family members.

5.2.3 Socioeconomic barriers

Attrition in the program is also linked to socioeconomic factors, mainly household dynamics. First, despite men being the strongest agents in the initial adoption and purchase, attrition is more dependent on the female agents, since they tend to be the main users of the new stove (Debbi et al., 2014). However, the relevance of the male partners in the decision to abandon the clean stove has now become almost equally covered by the current body of literature (Thompson et al., 2018). In households with educational imbalances, this lack of marketability of the program to men causes attrition, as the decision-making individual is the men and the efforts are concentrated in the women.

Children presence and female presence in the household are strongly correlated with short-term and long-term adoption of a clean cooking fuel. This is most likely due to the fact that safety and health benefits of clean cooking programs are strongly acknowledged by households that are aware that these demographics are more likely to be more affected by pollution (Gould et al., 2018; Rehfuess et al., 2014). When designing the project, it is important to focus on savings and efficiency to convince the men in the negotiations. They are the ones who control the finances of the household, safety and health, and who can convince the women (Rehfuess et al., 2014). Women usually sway more their reaction to the programs based on topics that relate to these concepts. No part of the household should be neglected in the marketing approach, as both have high influence in the effectiveness of the initiative (Rehfuess et al., 2014). It is also known that income tends to be a good predictor of sustained use, as more resources can be funneled in order to sustain use (Thompson et al., 2018).

5.2.4 Community-based barriers

As in the pre-adoption phase, the perception of the program and the stoves by the community plays a role in its continued usage and can have spillover effects over the neighboring users. The perception of positive changes inside the household, such as that of a cleaner kitchen, is a benefit that incentivizes continuous use (Debbi et al., 2014). The stoves must be perceived as tools to be used daily and not as ostentatious additions to the household, since it has been reported that in some communities if stoves are seen as thing of much value they might be unused, and instead be seen as an ornament of the house and a statement of its social status (Thompson et al., 2018).

Community involvement is key to increase the resilience of abandoning the new stoves. To this end, it is important to develop and create a supply chain of fuel and maintenance that involves the local actors and businesses. One main reason why projects fail is because of the short term implementation of those projects, not focusing on the sustainable use of the stove and the production and implementation phase ends, hindering their long term use (Debbi et al., 2014). To prevent this, it is important to work with local masons who can train the potential users, so that they can produce, build and repair clean cooking stoves, guarantee the supply of fuels adequate to the cookstove on site, and allow the program to win the

trust of the community members (Debbi et al., 2014; Gould et al., 2018; Puzzolo et al., 2016; Rehfuess et al., 2014).

User training in the first two weeks is additionally extremely important, as it solves the most common early attrition problems with the new technology (Debbi et al., 2014). As a direct consequence of the local masons having the know-how required, a more durable and less flawed construction takes place, and less attrition is detected (Rehfuess et al., 2014). Beyond the construction, maintenance is key, and the higher the concentration of masons, the higher the means of continued support in case any inconvenience arises, which could decrease attrition (Rehfuess et al., 2014). Both construction and maintenance benefit local masons. They induce a higher trust in the technology by the users, as reflected in the consequential decrease in attrition (Puzzolo et al., 2016). In order to increase community involvement, thus decreasing attrition, it is important to create long-run projects that involve masons. This is a way to create local development. This development will bring sustainability to the whole chain of acquisition. In order to involve masons in the project, training is needed. Box 4 illustrates the importance of the kitchen stove maintenance and technical assistance looking at the specific case of clean cooking programs in Peru.

In general, improved kitchens show good performance for household use; however, they show deterioration over time after installation. In the evaluation of the Improved Kitchens Program, IPSOS (2012) identifies that 87% of beneficiary households certify the proper functioning of the installed improved kitchen. Households reported that improved kitchens stopped working sometime after installation (between one to two years). Similar conclusions are detailed in IPSOS (2013a, b, c), where it is evident that knowledge on the management of improved kitchens are important for their durability.

Households that receive some intervention or training show better results in fuel use. The study by Johnson et al. (2016), which compares India, Nepal and Peru, indicates that, in the Peruvian case, the impact of improved cooking training and maintenance seems to be significant, given that users who did not receive training did not significantly reduce the consumption of firewood, while those with training and maintenance showed the greatest savings, that stands at 66% per capita per meal. Even those who received the support of the Inkawasi program but not a training also demonstrated significant fuel savings compared to 50% per capita baseline users per meal.

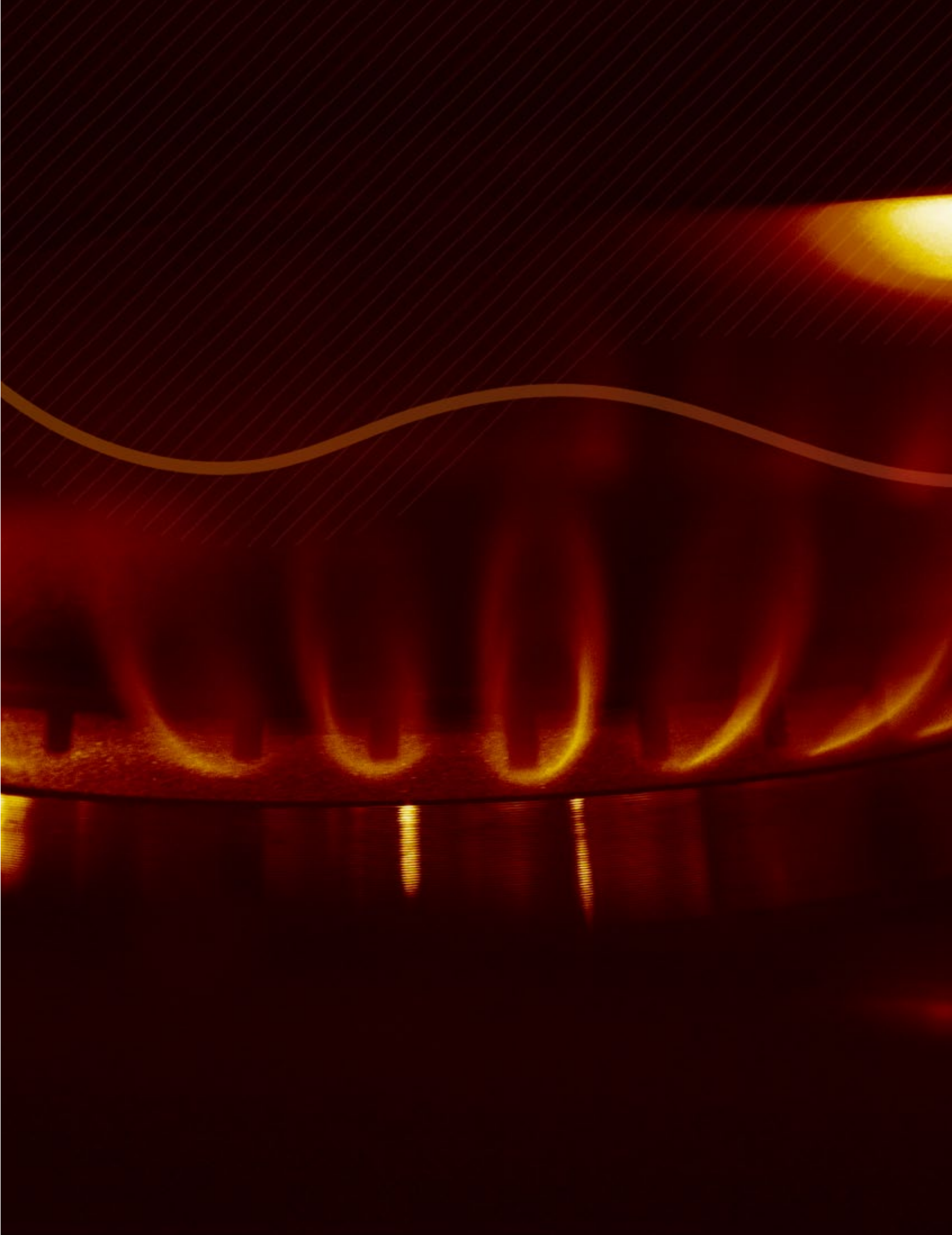
Households do not know who to turn to if their kitchen requires repair and access to spare parts; nevertheless, they show disposition to find solutions for their improved kitchen. In the evaluation of the kitchens installed by the NINA Project, IPSOS (2012) identified that only 19% of beneficiaries know who to turn to to repair their improved kitchen. In this line, only 16% know where to find their kitchen parts. This situation is more critical in areas with less access to markets. Those who declare that their kitchen does not work correspond to a very small proportion, so their answers do not allow statistical inferences. Taking this warning into account, it should be noted that in most of these few cases, the kitchens stopped working in the last year. Among the reasons why they did not repair the improved kitchens, this small group mentions not finding the damaged parts, not having the money, not having the time to contact a technician, or being accustomed to the traditional kitchen or stove and preferring it for that reason. The reported repairs were attended in more than a third of the total cases of breakdown (37%) by the NINA Project, and in a quarter of the cases (25%) by a family member or by a friend. The service did not require any payment, except for some cases in which the person who provided the service was fed. In general, most problems occurred in the combustion chamber (80% of cases).

Box 4. Kitchen maintenance and technical assistance in the case of Peruvian clean cooking programs

In summary, in order to slow down attrition and increase the efficacy and efficiency of clean cooking programs, several of the post-adoption barriers need to be overcome. The first of them is a financial barrier, where the supply of relatively cheap fuel is needed, and where low maintenance costs are required. The second type of post-adoption barrier linked to cultural and tradition is one of the biggest challenges. More specifically, it has to do with the inadequacy of the stove to meet local needs. The inability to cook traditional food in the modern stoves is the strongest cause of attrition. Stoves should adapt to local dishes. One example is that of tortilla making, which was mentioned several times in the semi-structured interviews carried out in Guatemala. Customary uses of the oven for other activities beyond cooking are also relevant for long-term attrition and adoption. The inability for the “plancha” style stoves and other cookstoves to heat or light a room has been reported as a reason for attrition, especially in colder climates and rural communities. For rural communities, the lack of durability in the design of the stove is a key barrier, since they tend to lack a less immediate maintenance access for a critical element of their household. If improvements were to be made in this regard a noticeable increase in long term adoption would be achieved.

Socioeconomic post-adoption barriers are linked to household dynamics, gender imbalances, and the composition of the household, e.g. whether there is a baby. Finally, community-based barriers have to do with local involvement, and the need for the creation of a local sustainable supply chain that will guarantee high trust, for example, leading to low levels of attrition in most communities.

It is worth mentioning that in most cases, there is not necessarily one barrier that is the main reason why households do not adopt clean cooking practices, or why they adopt and they go back to their old cooking habits or use both at the same time. In fact, it is usually a combination of different factors that together are an obstacle to clean cooking adoption. This can sometimes be challenging in identifying what these barriers are, especially without conducting on the field in-depth research. For instance, in a study on the adoption of clean cooking practices in Peru, Hollada et al. (2017) found that households appeared to be suspicious of improved cooking due to a combination of safety, cultural, economic and sustainability factors. They identified six main barriers to achieving a permanent use of clean stoves: (i) perceived differences in the taste and nutrition of food by type of stove; (ii) kitchen niches filled by different stoves; (iii) social norms related to cooking practices; (iv) security concerns; (v) comparative costs of using different stoves; and (vi) lack of awareness and concern about long-term health risks.



6 POLICY RECOMMENDATIONS: WHAT CAN BE DONE AND FOR WHOM?

This section presents a set of policy recommendations, based on the previous section on pre- and post-adoption barriers, on the empirical analysis carried out in the present work, and on general knowledge and experience in the field of clean cooking. The first section focuses on demand-side policies. The second section looks at policies on the supply-side. They should be considered together in policy-making targeted at enhancing clean cooking, as they constitute two sides of the same coin.

6.1 Demand-side

As was just shown, the biggest challenges to the pre-adoption and post-adoption phases vary. Failures in programs are attributable to several factors and there is no common denominator of failure. Despite the heterogeneity in the problems, some barriers are stronger and more prevalent than others. From these barriers, we can make some policy recommendations that focus on the demand-side by looking at how households can be incentivized to adopt clean cooking.

One recommendation is to provide the household with access to water. Without it, implementation of the clean cooking program is not feasible, as hygiene practices are not possible to be held without water. It is a perfect predictor of attrition. The same applies to access to electricity, which is a strong predictor of uptake and a key component of adoption. Access to electricity is sometimes not enough on its own. Some of the low adoption has been the result of poor quality of the energy services, where frequent and long electricity blackouts or brownouts prevent households from completing their food preparation or cooking, whereas this problem was less frequent when the household had to rely on its own supply of fuel wood or gas. Therefore, lack of electricity or poor-quality energy services, which is prevalent in some communities, hinders the implementation of the programs, as several stoves require constant electricity in order to work and operate, in the case of a transition to electrical stoves.

One key area that could be improved has to do with the spread of knowledge about the safe use of the modern cookstoves. The lack of household knowledge is a deterrent to adoption. This effect is enhanced by the misinformed fear of explosions of oil-based cookstoves. A negative effect usually emanates from close friends or relatives' experiences with clean cooking stoves.

Another area of improvement is that of access to credit. In its absence, adoption is limited greatly in both pre- and post-phases, as clean cooking stoves compete in the household budget with other household necessities. In this line, the reliability of the savings motivated by the new stove fuel are highly relevant to the decision. As such, the high price volatility of fuels is a significant deterrent to adoption and makes attrition more likely.

One area that could be improved has to do with educational programs. Educational programs would consist of two parts. On the one hand, they would inform the potential users about all the benefits related to health, safety, and life expectancy that clean cooking stoves adoption can bring about, both in the short and in the long term. On the other hand, they would show users how to make the best and most efficient use of the modern stoves. Ideally, the former would happen before the implementation of the program, whereas the latter should happen at the very beginning of the implementation, when the households are just starting to use the modern equipment.

The first part of the educational program about the benefits should be targeting house owners in particular in order to be effective, as they are the ones who make the decision, and as they can perceive the modern stove as an investment for the household. In addition, targeting women would also be effective. Observations from our interviews in Guatemala showed that often it was the women who were the first perceivers of the benefits of clean cooking stoves, and that promoted the idea of adoption to their husband, who would then have the final word. In fact, we were able to take part in an empowering workshop for women, during which they were told about the benefits of clean cooking stoves, along with some hygiene habits, for instance, and also shown how to make the best use of the clean cooking stoves. Women from the community we visited in rural Guatemala have to attend these workshops regularly in order to later have access to the clean cooking stoves that is being sold at a reduced rate by the NGO.

Along the same line, one area that deserves more attention and effort is that of female labor participation. A higher participation of women in the labor market could trigger higher adoption of clean cooking stoves. This is the case through two mechanisms. The first one is that women, who are usually the ones who cook in the household and who therefore have a bigger use of the cooking stove and understanding of the needs, do not have their own income, as they are excluded from the labor market, and if they do work, then usually they have low-paid jobs. This means that they are not able to pay the cooking stoves themselves and that they depend on the male household for the purchase of the stove. The second point is that if more women work and are therefore integrated in the labor market and the labor force, they can have a bigger influence or say in the decision about clean cooking stoves adoption, and perhaps also be more informed about their use.

Based on our empirical evidence in Section 3, smaller families are more likely to adopt, even though the families that usually need the clean cooking stoves the most are larger ones. However, stoves with two or one fires could be perceived as inconvenient, as larger families face bigger kitchens needs. As such, marketing is one of the key components of a clean cooking program and several improvements can be made in this aspect. This is key to trigger demand. It is important to market the stove as a high value commodity to make it more desirable. Community support of the program will report good outcomes, as it makes the program more trustworthy. This marketing hand in hand with the educational programs mentioned above should also work towards acting against the gossips and fears of stove explosions.

Financially speaking, adding a modest subvention to the stove (i.e. not a full subsidy) and/or its energy source also shows to increase the probability of adoption. We would make the point that a full subsidy of the stove is not desirable, because it destroys the incentive of the household to acquire the clean cooking stove. By contrast, if the household has to pay for it, it means that it truly needs the modern stove on the one hand, and that it might also invest more

in its maintenance on the other hand. This is also something that emerged in our interviews in rural Guatemala. The NGO we were in touch with explained that they were selling the improved kitchens at 10% of its original price instead of giving them for free, and that this helped maintain an economic incentive for the household to save some money so that they could afford the improved kitchen that at that stage they would believe are indispensable to their cooking. In addition, fuel supply and easy access via well-connected roads are a big factor for adoption. All these factors should be taken in account when designing the programs.

Other barriers that are cultural or traditional in nature are more difficult to overcome. To this extent, one recommendation is to accommodate the modern cooking stoves on a case-by-case approach. For instance, pots and pans that can be used that are suitable for electric cooking stoves but that are not too different from the traditional ones in terms of size or practicality could be given with the modern stoves. Alternatively, mosquito nets or anti-mosquito sprays could also be provided in parallel to the new cooking stoves. These suggestions are of course not perfect and would require further analysis and investigation, as they probably do not come without their own negative effects. For instance, using anti-mosquito spray inside the household, especially if it consists of only one room, can also potentially be harmful for health, because of the inhalation of chemicals that it contains. In this specific case scenario, there might be a need for evaluating and comparing negative consequences of having fuel-based cooking stoves versus using anti-mosquito spray extensively inside the household.

This example on the alleged benefits of smoke from an open wood fire acting as an insect repellent is helpful to support the argument of the need for a case-by-case approach. Though the literature provides evidence that it is useful to chase insects, in one of the interviews carried out in Guatemala during our fieldwork, a household member stated that actually there were even more flies before when they were using the open wood fire outside because they were in open air and because there is a farm nearby. In their specific case, using the modern cooking stove had the benefit of reducing the presence of flies, as the door could be closed (evidence can be found in section 6 of Interview 1 in Appendix 5).

Overall, we would argue that one of the biggest impediments to the adoption of clean cooking stoves where there is a big potential for improvement has to do with the spread of information about the health and safety benefits that clean cooking stoves can bring about. Poorer and less-informed households will not necessarily be aware that their deteriorating physical condition is fully linked to the use of their traditional cooking stove. While some short-term impacts on health are obvious, such as coughing and eye inflammation, it might be harder to link long-term impacts, such as high blood pressure, to trace them back to their origin. If the potential clean cooking stoves users were informed about the life expectancy increase that can result from adopting modern cooking stoves, they might value the health benefits more than maintaining cooking traditions. This would be a good starting point in terms of policy and initiatives to start moving towards higher adoption of clean cooking stoves.

Another area that could be improved to prevent attrition has to do with clean cooking stove and chimney maintenance and providing improved kitchens that are certified with a guarantee from the manufacturer. From our fieldwork in Guatemala, we could observe that improved kitchens had a viability of only a few years, especially as some of the women we interviewed mentioned that they cooked for at least 5 hours a day, every day, regardless of the time of the year. We noticed from our visits that many of the improved kitchens were deteriorating and in bad shape, sometimes bad enough that they were losing their initial purpose of reducing the air pollution inside the house, as either the chimney was broken, or the combustion chamber had some cracks. The main problems households said to be facing in the case of a no-longer operational and efficient improved kitchen is that they would not necessarily know who to turn to, where to look for someone to come repair it, and also do not necessarily have the financial resources to pay for repair. And this is in the case where households were aware that their kitchen was malfunctioning. In some cases, it was not obvious at all. We return to this below in the section on supply-side policy recommendations.

Whereas this section was an attempt to offer some policy recommendations and how to overcome barriers, we do not pretend to have covered all possibilities for policies focused on clean cooking programs. Neither do we pretend to have a “one-size-fits-all” solution that can be replicated to all case studies. As we showed in Section 3, each country, or even region or community within the country, is different because of its geography, history, economy, and culture. Clean cooking programs and policies need to be tailored according to the populations that they are targeting, and the needs of these. To recall our framework to analyze programs depicted in Figure 2, each dimension of time, coverage and subsidy type will and needs to vary according to the case study. We now turn to policies that focus on the supply-side.

6.2 Supply-side

Building a foundation for a long-term technological innovation scheme requires supporting a timely, feasible and successful transition to a sustainable Standards & Labelling (S&L) policy. An enhanced regulatory framework is needed to provide manufacturers the incentives to improve the quality, reliability, and durability of ICS. As part of this process, exchanges of experience with countries that already count with an institutional and regulatory framework such as Bolivia, Mexico or Peru should be organized, as a way to encourage national actors to take action in this realm, transferring lessons learned, sharing successful strategies and potential pitfalls.

To develop a sound policy, regular input from relevant actors is needed to share updates from their work and to provide inputs to the development of quality criteria, performance standards, test methods, market assessments, incentive programs, and more. They include participants from the national metrology agency, manufacturers, test laboratory candidates, and other interested parties. An enhanced regulatory framework include pre-adoption, adoption and post-adoption activities as follows.

6.2.1 Pre-adoption

The pre-adoption phase includes the rules and regulations to certify ICS. In the case where countries have not adopted Standards and Labeling, as is the case of Guatemala, Honduras or Nicaragua, certain requisites need to be in place to have a successful framework. These include norms and laboratory certification.

6.2.1.1 Norms

Norms describe the minimum requirements that ICS need to comply in terms of security, energy efficiency and particulate emissions. Examples of countries in the region with a complete set of norms are Bolivia, Chile, Mexico, and Perú. These countries have developed their norms based on international standards, such as ISO's ISO-19867-1:2018. Clean cookstoves and clean cooking solutions - Harmonized laboratory test protocols-Part 1: Standard Test Sequence for emissions and performance, safety, and durability. It is important that they include requirements to qualify to carbon financing (or at least make them compatible with the international standard). In the case that the country does not have a norm related to cookstoves, close coordination with the metrology agency (i.e., the government agency in charge of preparing, adopting and supervising the use of S&L) is required, providing them with technical assistance. A laboratory to be accredited should also be selected to perform efficiency determination and quality assurance. S&L should not have a conflict with the Gold Standard,¹⁶ as it is the preferred standard to evaluate ICS performance, and used in Carbon markets.

16. The Gold Standard (2015) Technologies and Practices to Displace Decentralized Thermal Energy Consumption Version 2.0. http://www.goldstandard.org/sites/default/files/revised-tpddtec-methodology_april-2015_final-clean.pdf

Standard & Labelling policies are proven market transformation tools. In the US, for example, S&L policies have contributed to almost a four-fold decrease in energy consumption¹⁷. Product standards remove lowest-performing products from the market, while labels convey information to consumers to stimulate the purchase of high-performing products. Labels consequently drive innovation and competition among manufacturers by rewarding high-performing products. Enacting an S&L process also creates an environment conducive to broader market transformation efforts, such as technological innovation initiatives, awards and incentive programs, or consumer finance mechanisms. In the past five years, the principles and components of S&L have been applied to early-stage market development efforts with great success. Relevant examples include traditional government-led S&L programs, like the Ghana Energy Efficiency Label¹⁸ (for refrigerators and air conditioners), and industry-focused programs, such as Lighting Global.¹⁹ Based on these experiences, a S&L schemes should be introduced²⁰ to encourage and lead the market to produce higher quality products.

A label by itself might not automatically crowd out uncertified products, and that the results of past and existing experiences are mixed. Among the main limitations of existing S&L schemes, the Lighting Global, many producers feel that the process is too long, too inflexible, and too costly. Efforts should be made to ensure fast, flexible, and cheap testing (subsidized testing for the first 15 evaluations). Experience in Peru shows that, once the ICS market is created, manufacturers are able and motivated to pay for stove testing on their own. As a voluntary scheme, only importers willing to test and certify their stove will do so. To increase S&L effectiveness, efforts should be also made to convince donors to only promote/distribute efficient stoves.

In LAC, the experience of Peru has demonstrated that counting with a technical standard for improved cookstoves, a law regulating the evaluation and certification of improved cookstoves, as well as a dedicated laboratory certified to perform such evaluations was key for the effectiveness and sustainability of ICS interventions. While a national norm on improved cookstoves will not automatically remove all the barriers to market development, and will not (on its own) ensure sustainability, there is a large consensus among all manufacturers consulted during the appraisal phase on the need to establish a norm in order to ensure loyal competition among ICS manufacturers and restore confidence amongst consumers who might not have always perceived the benefits of so-called ICS that were in fact not really efficient and have lost interest and trust in the technology.

6.2.1.2 Laboratory Certification

S&L need to be tested in accredited laboratories by the norms institute (such as SENCICO in Perú or COGUANOR in Guatemala). Efforts need to be made to have at least one laboratory to test the ICS and receive the certification. Labelling of the certification can take many forms. One is norm compliance such as an Energy Star label. Another is quoting the actual savings. Progression is recommended, but certainly a label needs to be included to notify the potential buyer.

S&L and certification is valuable as long as the consumer is aware of its usefulness, and therefore, significant efforts need to be made to create awareness of the importance of standards and labels, and why they benefit the user. Creating awareness can be made in two ways that could be complementary: (i) Mandate that only efficient, certified ICS are promoted, subsidized, or provided by local and national authorities, and convince donors to only include ICS that are efficient in their programs; and (ii) create and implement education campaigns to create

17. <http://aceee.org/blog/2014/09/how-your-refrigerator-has-kept-its-co>

18. <http://clasp.ngo/en/OurPrograms/SuccessStories/Ghana>

19. <https://www.lightingglobal.org>

awareness in the population. This campaign should be extensive, have a national reach, and with a long-term perspective to sustain the awareness. On the other hand, the Enhanced regulatory framework for ICS should be complemented with incentives (ideally through results-based funding) to manufacturers, promoting the adoption of minimum standards of production.

Once the norm adopted, a competitive process should be used to select the laboratory or laboratories to provide the certifications and labels. An evaluation of existing laboratories should be made to determine if they have capacities and potential to perform ICS tests in the country. An evaluation of the size of the potential market should be made, though, because of economies of scale and specialization needs, only one certification laboratory might be economically feasible. A selection process ex-ante, therefore, should be made, usually among national public laboratories or laboratories associated with universities. The laboratory to be certified would receive expert support and training, including exchanges of experience with laboratories in the region (for example Bolivia, Mexico, or Peru), to improve their testing capacities; as well as material as needed. The S&L mechanism should be designed to be agile and helpful in the labelling efforts undertaken by the sector.

At institutional level, advocacy actions should also be undertaken to promote an ICS market-building approach among key stakeholders: donors, manufacturers, and distributors. Because the market has relied on donations for such a long time, it is necessary to create a series of disincentives to ensure that these key stakeholders switch from a donation approach to a market building approach as donations could hinder market-building prospects.

The experience of Peru, Bolivia or Honduras shows the importance of investing in strengthening national capacity for research, development and testing of ICS to achieve intended GHG reductions and access carbon finance. In Guatemala, GIZ, UNDP and USAID-LEDS have paved the way, by improving the capacities of the USAC to perform ICS laboratory tests. Efforts should be made to enhance limited capacity, credibility, and trust amongst manufacturers.

6.2.2 During the adoption

An analysis of the ecosystem of companies that would be needed to provide services is required, including analysis, calibration, supplies, equipment, and other activities related to the evaluation of conformity of products, processes, and services. In case a multiprong approach to introduce technological change is selected, for example the replacement of gas, electric or firewood cookstoves for efficient induction cookstoves under public policies for the massification of the results of successful pilot projects, including on access to alternative cooking technologies. The public policy would be to allow the distribution company to create a fund, and include it in the base tariff, to finance. When promoting technological change, consideration should be made to also provide the regulatory environment to the new product described above. To avoid unnecessary delays, the new technology would need to comply with international standards. If the new technology is sold in the country of origin, they would need to demonstrate that they fulfill that country's standards and provide certification of origin. An example could be induction stoves imports.

Efforts should also be made to standardize sizes and specifications, in order to promote a competitive market in the spare parts segments of the industry and increase availability. Although proprietary designs are difficult in this industry, as there is little room for patents or designs that cannot be copied, efforts to increase profitability might come from special designs that could fetch premium prices when replacing parts. The industry as a whole, however, might suffer. If users find it difficult to find a spare part, or price differences compared to the competitors are significant, this might disincentivize the use of the stove. Efforts to standardize sizes, performance and procedures of use will benefit the industry as a whole.

Certification and labelling of products need to meet the established performance criteria for efficiency, emissions, and safety to improve confidence among consumers and investors. For in-situ stoves, the norm might include aspects regarding their installation. In Peru and Mexico, the

existing certification scheme only guarantees that the model of the in-situ stove complies with the standards evaluated, but does not guarantee that the stoves built in situ comply with these certified standards and that the technicians responsible for their construction are adequately trained. A norm is hence needed to certify the quality of the installed stoves and, at the same time, installers and stove builders must be certified and not only the product. In Peru, a technical standard for validation of in-situ stoves in the field is currently being discussed, which will be part of an annex to the regulation for the evaluation and certification of in-situ stoves. In Mexico, through the Patsari Network, a group of project developers and producers of improved Patsari stoves have been grouped, which are certified as installers by GIRA in order to install them properly and meet the standards of quality required. We believe a similar approach could be adopted in Guatemala.

An approach that encourages and pulls the market toward producing higher quality products should be adopted, encouraging manufacturers to produce better products to receive label that provides a competitive advantage. The certification process will have three results: (a) a statement on the standard compliance of the product (b) a label on the efficiency category the ICS belongs to (b) suggestions on how to improve the product/processes and the possibility for manufacturers to access, on demand, to trainings to enhance their capacity to meet criteria and to perform efficiency tests themselves in order to be able to work on prototyping/innovation.

Multiple stakeholders could voice different opinions and hesitations regarding the efficiency of ICS and the soundness of existing market data, e.g. on size of the cookstoves market, firewood consumption rates, opportunities for non-biomass cookstoves, and emissions that can be reduced using clean cookstoves. To address this scepticism, efforts should be made to make this information public, to increase awareness of the benefits of clean and efficient cookstoves and the existence of the certification and label scheme. Well researched and communicated market data should be published to increase buy-in to policy efforts. A product database should also be built and a product registration and certification database, also known as a qualified products list, should be implemented, in which cookstove manufacturers or suppliers must register product models to be promoted. Information to be provided would include evaluation results, warranty information, other relevant product criteria, number of products placed on the market (produced/imported) and contact information of the manufacturer or suppliers. The information should be certified by the testing reports and information provided by the laboratory.

S&L best practice encourages the use of product databases to support registration or certification of products in a program, as well as the monitoring and enforcement of products in a program. A central qualified product list populated by certified products tested to an established set of rigorous performance criteria can be an enormously helpful tool to ensure procurement officials, financial institutions, and donor organizations are selecting high-quality and high-efficiency products. While the catalogue is static, the database can be regularly and easily updated to reflect more ambitious product criteria or newer product models (without having to reprint numerous physical catalogues). This tool can be referenced by anyone anywhere, granting more users access to this product information. The data contained within these tools can also be used to inform project monitoring and evaluation efforts, as well as provide up to date market data for market assessments and updates to product criteria both under the current or under a future S&L program. The online database may even be used as a regional resource (e.g. for comparison of cookstoves' efficiency levels available) and could be expanded to include relevant products from other markets that also meet the product requirements. This can help increase access to different markets across borders and helps pave the way to more aligned standards.

To encourage manufacturers to participate to the S&L scheme, incentives might be needed, especially during the initial period when implementing the norm. Incentives in a nascent market such as cookstoves help reduce risk across the supply chain by (i) lowering the cost for manufacturers that invest in the production of high-quality products; and (ii) providing clear options to manufacturers to scale up their business. An incentives program is more successful if it also ensures that only the most high-quality and efficient products are rewarded, as this

increases ambition among other manufacturers who will make changes to their products to reap the program benefits. While S&L schemes have many benefits, a typical danger is that they become exclusive rather than inclusive. It is also important that these incentives are short-lived and have a set expiration date.

Result-based incentives should be used, to incentivize manufacturers to participate in the market, by establishing a results-based financing model to support their efforts. A share of carbon funding generated by the commercialization of carbon credits could also be used, targeting high performers, based on quality and efficiency standards, to ensure long term success of the S&L and that beneficiaries receive best in class products.

6.2.2.1 Awareness campaign

On the demand side, barriers to the sustained adoption of clean cooking include the cost of clean fuel and related equipment, perceptions about the taste of food, and a lack of understanding of the impact of polluting fuels on health and the environment. In other words, clean cooking depends not only on families' financial conditions and the accessibility of clean technologies and fuels but also on their preferences. Therefore, awareness campaigns are a vital component of clean cooking policies. Examples of strategies to raise awareness about using clean fuels are advertising campaigns, school education programs, family training, cooking contests, and partnerships with civil society and community organizations.

6.2.2.2 Cost reduction of stoves using clean fuel

A barrier to the transition to clean cooking technologies is the high costs of new stoves. Reducing the costs of stoves that use clean fuel can significantly improve their diffusion. Lowering the cost of cooking stoves can be achieved by eliminating taxes, including import taxes, for families that prove they have a wood stove or by programs focused on the most deprived communities. Alternatively, or in combination, accessing to efficient cookstoves could be achieved by establishing policies and lowering access barriers to financing. In Guatemala, for example, the net benefit of ownership is a monthly positive cash flow to the user. This is, after the down payment to acquire the stove in installments, the savings in the purchase of firewood more than compensate the payments that the user has to make to the financial institution, generating incentives to purchase an efficient stove.

6.2.3 Post-adoption

Post-adoption strategies are important to evaluate the advances made under the existing strategy and adopt changes in the areas that need to be reinforced. This includes determining the effectiveness of the S&L, how the overall quality in the industry improved, and increases in adoption due to greater awareness and access improvement activities.

6.2.3.1 Evaluate the success of implementing S&L

It is expected that the S&L scheme will transform the market by removing poor-performing or low-quality products, while the labelling program will encourage and empower consumers and other buyers to make informed decisions about the products they purchase. This approach will create fewer upfront barriers to private sector investment in the cookstoves sector and supports a timely, feasible and successful transition to a sustainable S&L program in the long term.

To evaluate the success of the S&L in triggering a transformational change, studies should be conducted to evaluate the success of product requirements, test procedures, use of a certification database, and label. The evaluation will have to include views from program implementers, manufacturers, test laboratory, and costumers. lessons learned about the manufacturers (challenges faced in the adoption and implementation of standards, in the upscaling of their business, the improvement of their distribution strategy, ...)

Testing is not only important for proving standard compliance, but also for prototyping/innovation. The latter is very important if one aims at dynamic market development. Such tests are, however, often not done in laboratories but at manufacturer's sites. Efforts should include building capacities of manufacturers' stove testing.

The S&L scheme should be combined with consumer awareness raising, and result-based funding mechanisms. The result-based funding program will enable high performers to access extra funding through award programmes and the commercialization of carbon credits, of which they would receive a share. Award schemes for best-performing products such as Global LEAP²¹ have showed successful in stimulating markets. The organization of design and marketing award and competitions for best-performing products would be one tool to incentivize the production of higher quality products and innovative marketing strategies.

In terms of advocacy, the ENDEV experience in Peru has demonstrated the need to advocate at the central government level so that public procurement processes targets certified efficient stoves only. The experience also demonstrated the importance of having an inter-institutional advocacy platform to address the issue of reducing emissions in the firewood sector.

6.2.3.2 Funding from the commercialization of carbon certificates

A share of carbon funding generated by the commercialization of related carbon credit might be targeted to high performers, based on quality and efficiency standards compliance, to ensure long term success of the S&L and that beneficiaries receive best in class products.

Lessons learned from regional and international projects (e.g. the Mirador Project in Honduras, New Lao in Cambodia, UgaStove in Uganda) reveal that financial flows from voluntary carbon markets can help make sustainable the growth of the local ICS market, making affordable stove prices possible, as well as quality guarantees and permanent maintenance systems. This financial scheme rewards the good management and marketing practices of the stove manufacturers, since the revenues only occur when the external audits of the project determine the effective use of the product. Building on these experiences, emission reduction credits to access carbon finance should be timed to be generate when it is economically optimal. The carbon funding will be used to sustain the induction stove voucher programme beyond the pilot; to reward high performers among manufacturers; and eventually to help reduce the retail price of ICS. Other policy recommendations.

6.2.3.3 Besides S&L activities and awareness campaigns, other policy options worth exploring to promote a more efficient use of fuels and reduce energy poverty include:

- Enforcement of illegal wood extraction
- Regulation of firewood trade
- Technology substitution towards electric induction stoves by, for example, lowering import duties
- Promote bankarization to facilitate the creation of a market for ICS

21. <http://globalleap.org/>



7 CONCLUSION

This document has sought to answer three questions centered around clean cooking programs in Latin America and the Caribbean, with a focus on Guatemala, Peru and Ecuador. These are: who uses clean cooking?; what are the impact of clean cooking?; and what are the barriers to clean cooking?

The first question was answered by looking at characteristics of poor households that use firewood and those that do not, in order to identify which households clean cooking programs need to target. We were also able to observe by how much the probability of adopting increased depending on the different characteristics of households, such as where they are located, how many members they have, whether they have a collected bins' system, and so on. Additionally, we created a "Clean Cookingness" index that we correlated with household income to assess whether the latter was a strong determinant of adoption, and how the likelihood of adoption varied according to different income levels. We were able to carry out this empirical analysis by relying on unique harmonized household survey data and three different econometric methods, and to support the interpretation of our results for Guatemala with the complementary fieldwork that was carried out.

Findings for question one showed that access to clean cooking and characteristics of populations that use clean cooking vary considerably by country, and even within each country, and that a thorough analysis is needed in order to tailor clean cooking programs accordingly to the needs of the populations. We could also conclude that characteristics such as income, education, gender, age, living zone, number of household members, home ownership, bin collection system and being a household head all mattered for the adoption of clean cooking, though to different degrees depending on the case study.

The second question on the impact of clean cooking programs sought to highlight how important these are in terms of health and increasing life expectancy. We replied to it by briefly reviewing the existing literature on the air pollution and consequent health impacts of traditional cooking stoves and benefits of a transition. We then reported evidence from data collected during our fieldwork in Guatemala on the levels of air pollution of households according to their cooking methods. We also investigated the case of the different clean cooking programs in Peru by relying on secondary sources.

Results from the HAPIT model coincided with the literature that highlights the positive impact on health of adopting clean cooking practices. Improvements were seen in diseases related to lungs and other respiratory outcomes, heart, strokes, as well as to life expectancy and the incidence of death.

Our last question on the barriers to adoption was answered through an extensive review of the literature, in some instance supported by our interviews in Guatemala. This was done by dividing barriers between the pre-adoption phase and the post-adoption phase. The first one has to do with the period before the households buy or start using the improved one. The second phase happens when the households have already used the improved kitchen a few times, but do not continue to use it, eventually leading to attrition. The pre- and post-adoption barriers were classified according to whether they were socio-economic, infrastructural, related to culture and tradition, community-based, informational, institutional or financial.

Barriers were shown to be diverse and also to depend on the phase of the adoption. They also appeared to be country-specific, as some findings for the case of Guatemala seemed contradictory to what the literature would suggest, though they could be interpreted in the specific Guatemalan context.

We concluded the research by making some policy recommendations that look at both the demand and the supply-side. On the demand-side that focuses on incentivizing households, the main takeaways are the need for access to water and energy services of high quality, as well as well-connected roads for fuel supply. A facilitated access to credit also matters. Knowledge spreading about the safe use of improved cookstoves and their benefits through educational programs are key. Higher female labor participation and product marketing can also enhance the adoption of clean cooking stoves. On the supply-side, an enhanced regulatory framework is essential. This includes norms, Standard & Labelling policies and their evaluation, laboratory certification, an awareness campaign, reducing the costs of stoves and carbon certificates. Additionally, the enforcement of the extraction of illegal wood and the regulation of the firewood trade is desirable in case where households buy their wood and this type of market exists.

Our work has many contributions. First, it makes an exclusive use of a harmonized household database for a selection of LAC countries that includes information on the fuel used by households for cooking, as well as a set of variables on the characteristics of households, such as composition, location and income, amongst others. This comprehensiveness allowed to make detailed analysis, and to explore different potential correlations between adoption and household characteristics.

Second, the present work uses both quantitative and qualitative evidence to support its arguments. The qualitative evidence is a value added on its own. It is the result of a mission on the field and real-time data collection on the quality of the air in households in rural Guatemala, as well as the collection of information from households in pre- and post-adoption phases of clean cooking, thanks to semi-structured interviews carried out in rural areas.

Last but not least, to the best of our knowledge, it is the first study that makes the dichotomy between pre- and post-adoption barriers, and that looks at all of them, as well as provides policy recommendations that address both the demand and the supply sides in a comprehensive way.

In a nutshell, the main takeaway from this work is that the concept of clean cooking is complex and unique to each case study, as we saw that there is considerable heterogeneity in the needs of populations or their characteristics even within the same country. There is no universal solution to the problem of traditional cooking stoves and the pollutants they emit. Programs need to be tailored with a specific targeted population in mind and include aspects that address this population's needs and that consider their characteristics. They should be accompanied by the right complementary policies that would prevent as much as possible the confrontation of obstacles. These should aim to be implemented before and during the adoption phase, as obstacles are present in both time dimensions. This is where there is room for further research and studies, preferably local, so that all these characteristics and needs can be identified. Whereas our fieldwork was carried out in one community in rural Guatemala, the picture 400km North of this community is very different and would require a fieldwork of its own.

One last key message is that there is an immediate need for efforts and action to promote clean cooking programs in countries in Latin America and the Caribbean. The results on the health impacts of using traditional cooking stoves that were shown above are real estimations based on people currently living in rural areas and who cook with fuel wood. Less emissions of the particulates from burning it would lead to considerable health benefits and increase life expectancy of vulnerable populations that are exposed to them constantly, especially women and children. This could help improve the lives of millions of people- 90 million, to be precise- which is the number of people in LAC that still relied on solid fuels for cooking in 2017.



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ARCONEL 2019

APPENDICE

APPENDIX 1: MULTICOLLINEARITY CHECKS

A.1.1 Case of Guatemala

| VARIABLES | Fuel wood | Poor | Zone | Elder | Sex | Head of household | Household size | Dwelling | Education | Home ownership | Bin collection |
|-------------------|-----------|-------|-------|-------|-------|-------------------|----------------|----------|-----------|----------------|----------------|
| Fuel wood | 1.00 | | | | | | | | | | |
| Poor | 0.27 | 1.00 | | | | | | | | | |
| Zone | -0.53 | -0.19 | 1.00 | | | | | | | | |
| Elder | -0.04 | -0.03 | 0.04 | 1.00 | | | | | | | |
| Sex | -0.02 | 0.01 | 0.02 | -0.18 | 1.00 | | | | | | |
| Head of household | -0.08 | 0.02 | 0.05 | 0.61 | -0.36 | 1.00 | | | | | |
| Household size | 0.31 | -0.01 | -0.20 | -0.09 | -0.01 | -0.19 | 1.00 | | | | |
| Dwelling | -0.12 | -0.09 | 0.11 | 0.02 | 0.00 | -0.04 | 0.13 | 1.00 | | | |
| Education | -0.38 | -0.28 | 0.27 | -0.08 | -0.06 | 0.00 | -0.15 | 0.12 | 1.00 | | |
| Home ownership | 0.29 | 0.03 | -0.26 | 0.03 | -0.01 | -0.05 | 0.13 | 0.05 | -0.08 | 1.00 | |
| Bin collection | -0.68 | -0.25 | 0.62 | 0.04 | 0.02 | 0.06 | -0.25 | 0.11 | 0.34 | -0.30 | 1.00 |

Table A1.1 Correlations between variables

| VARIABLE | VIF | 1/VIF |
|-----------------|-------------|-------|
| Bin collection | 1.88 | 0.533 |
| Zone | 1.66 | 0.601 |
| Education | 1.46 | 0.684 |
| House ownership | 1.16 | 0.864 |
| Poor | 1.16 | 0.864 |
| Elder | 1.13 | 0.885 |
| Household size | 1.09 | 0.914 |
| Sex | 1.05 | 0.949 |
| Dwelling | 1.04 | 0.961 |
| Mean VIF | 1.29 | |

Table A1.2 Vif test between variables following linear regression with fuel wood cooking as dependent variable

A.1.2 Case of Peru

| VARIABLES | Fuel wood | Poor | Zone | Elder | Sex | Head of household | Household size | Dwelling | Education | Home ownership |
|-------------------|-----------|-------|---------|-------|-------|-------------------|----------------|----------|-----------|----------------|
| Fuel wood | 1.00 | | | | | | | | | |
| Poor | 0.25 | 1.00 | | | | | | | | |
| Zone | -0.49 | -0.36 | 1 | | | | | | | |
| Elder | 0.00 | 0.12 | -0.0189 | 1.00 | | | | | | |
| Sex | -0.01 | 0.02 | 0.0161 | -0.17 | 1.00 | | | | | |
| Head of household | -0.02 | 0.07 | -0.0097 | 0.63 | -0.32 | 1.00 | | | | |
| Household size | 0.11 | -0.09 | -0.0528 | -0.18 | -0.01 | -0.21 | 1.00 | | | |
| Dwelling | -0.03 | -0.06 | 0.0253 | 0.02 | 0.00 | -0.01 | 0.00 | 1.00 | | |
| Education | -0.26 | -0.24 | 0.3153 | -0.06 | -0.07 | 0.08 | -0.06 | 0.04 | 1.00 | |
| Home ownership | 0.12 | 0.08 | -0.16 | 0.05 | -0.01 | -0.02 | 0.08 | 0.08 | -0.06 | 1.00 |

Table A1.3 Correlations between variables

| VARIABLE | VIF | 1/VIF |
|-----------------|-------------|-------|
| Zone | 1.4 | 0.716 |
| Education | 1.43 | 0.699 |
| House ownership | 1.07 | 0.933 |
| Poor | 1.16 | 0.864 |
| Elder | 1.14 | 0.876 |
| Household size | 1.07 | 0.935 |
| Sex | 1.08 | 0.926 |
| Dwelling | 1.02 | 0.984 |
| Mean VIF | 1.19 | |

Table A1.4 Vif test between variables following linear regression with fuel wood cooking as dependent variable


A.1.3 Case of Ecuador

| VARIABLES | Fuel wood | Poor | Zone | Elder | Sex | Head of household | Dwelling | Education | Home ownership | Bin collection |
|-------------------|-----------|-------|-------|-------|-------|-------------------|----------|-----------|----------------|----------------|
| Fuel wood | 1.00 | | | | | | | | | |
| Poor | 0.16 | 1.00 | | | | | | | | |
| Zone | -0.28 | -0.14 | 1.00 | | | | | | | |
| Elder | 0.02 | 0.08 | 0.00 | 1.00 | | | | | | |
| Sex | 0.00 | 0.02 | 0.02 | -0.18 | 1.00 | | | | | |
| Head of household | -0.01 | 0.05 | 0.02 | 0.62 | -0.33 | 1.00 | | | | |
| Dwelling | -0.14 | -0.08 | 0.10 | 0.00 | 0.01 | -0.03 | 1.00 | | | |
| Education | -0.15 | -0.12 | 0.27 | -0.10 | 0.00 | 0.01 | 0.15 | 1.00 | | |
| Home ownership | 0.08 | 0.05 | -0.23 | 0.07 | -0.01 | -0.03 | 0.04 | -0.06 | 1.00 | |
| Bin collection | -0.37 | -0.13 | 0.54 | -0.02 | 0.02 | 0.01 | 0.17 | 0.23 | -0.16 | 1.00 |

Table A1.5 Correlations between variables

| VARIABLE | VIF | 1/VIF |
|-----------------|------|-------|
| Bin collection | 1.47 | 0.678 |
| Zone | 1.59 | 0.629 |
| Education | 1.29 | 0.774 |
| House ownership | 1.12 | 0.893 |
| Poor | 1.07 | 0.936 |
| Elder | 1.13 | 0.886 |
| Sex | 1.03 | 0.972 |
| Dwelling | 1.07 | 0.937 |
| Mean VIF | 1.22 | |

Table A1.6 Vif test between variables following linear regression with fuel wood cooking as dependent variable.



APPENDIX 2: LATENT DE COMPOSITION ANALYSIS RESULTS

LCA is a probabilistic model combining at least two density functions within a single population distribution.

We can write the density of a g-component mixture model the following way:

$$f(x) = \sum_{i=1}^g \pi_i f_i(y|x'\beta_i)$$

Such that π_i is the probability for class i , which varies between 0 and 1, with $\sum \pi_i = 1$, and $f_i(\cdot)$ is the conditional probability density function for the observed response in the model for class i .

The LCA uses the multinomial logistic distribution to estimate the probabilities of the latent classes. The probability for latent class i can be written such that:

$$\pi_i = \frac{e^{(\gamma_i)}}{\sum_{j=1}^g e^{(\gamma_j)}}$$

Where γ_i is the linear prediction for the latent class i . the first latent class is the base level by default, such that $\gamma_i = 0$ and $e^{(\gamma_i)} = 1$. The likelihood is then computed as the sum of the probability-weighted conditional likelihood from each latent class. In our case we consider a binomial logistic distribution, meaning we assume two classes for each sub-group of poor households (wood users vs non-wood users).

Once we have run the FMM, we obtain two classes of poor households for each sub-group of fuel users. We then create a categorical variable that can take two possible values, each one belonging to one of the two classes, depending on whether the average probability of belonging to each class is equal or higher than 50%. We then run a logistic regression where we regress our categorical group variable on all our variables of interest, and then look at the marginal effects. Our model looks as follows:

$$f(k, l) = \beta_{0,k} + \beta_{1,k}z_{1,l} + \beta_{2,k}z_{2,l} + \dots + \beta_{m,k}z_{m,l}$$

Where $f(k, l)$ is the linear predictor function that determines the probability that observation l has outcome k . In our case, the latter can only take the two group values ($k=1,2$). We regress our outcome variable on 8 independent variables ($m=8$). Our independent variables are the zone where the household is located, whether the household head is elder, her or his gender, the size of the household, the dwelling type, the education level of the household member, whether the dwelling is owned or rented, whether bins are collected and the income level of the individual²².

22. Two tests have been carried out to check for multicollinearity between our independent variables; simple correlations and the Vif test. Their results can be found in Appendix 1.

Case of Guatemala

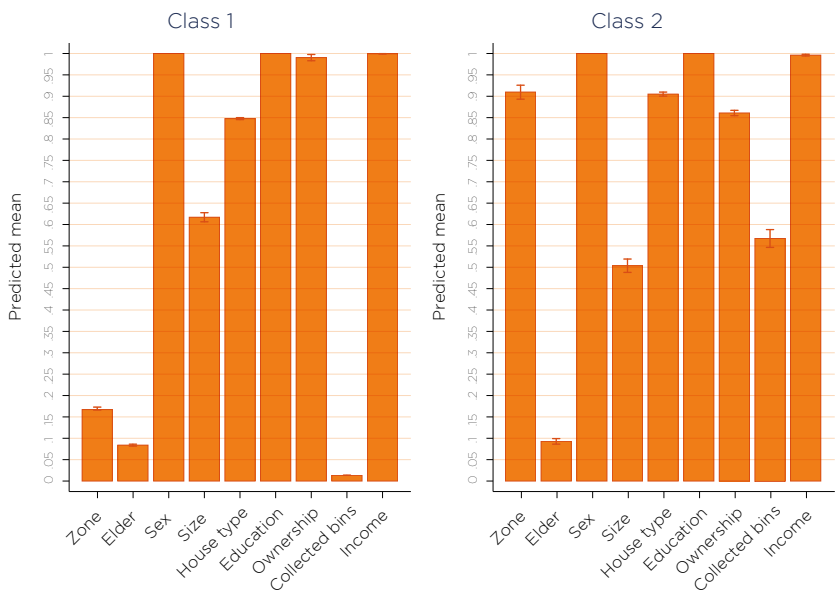


Figure A2.1 Sub-populations of poor households that use firewood in Guatemala

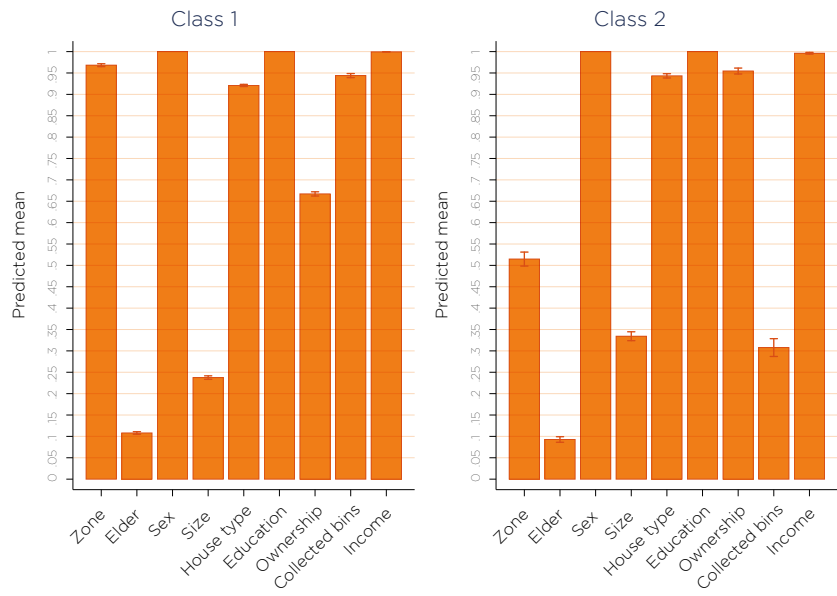


Figure A2.2 Sub-populations of poor households that use non-firewood (i.e. gas or electricity) in Guatemala

Case of Peru

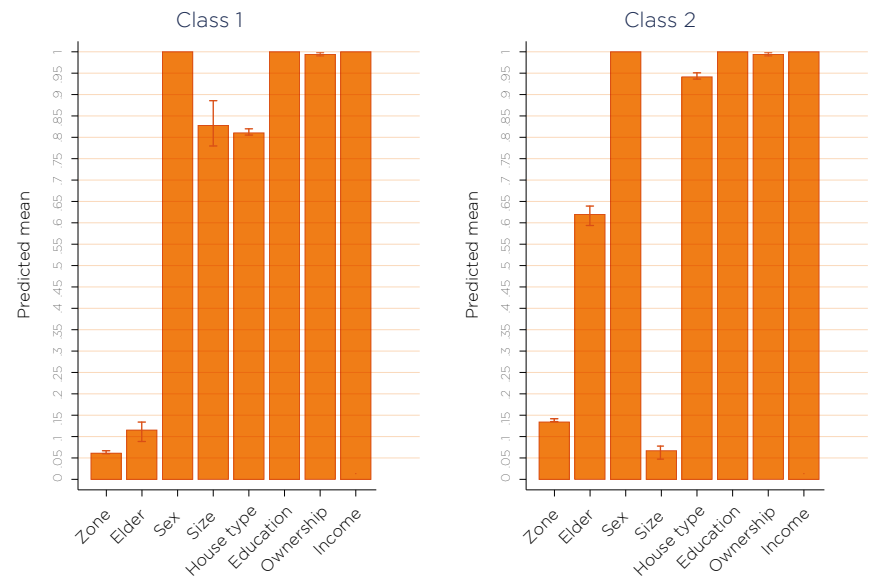


Figure A2.3 Sub-populations of poor households that use firewood in Peru

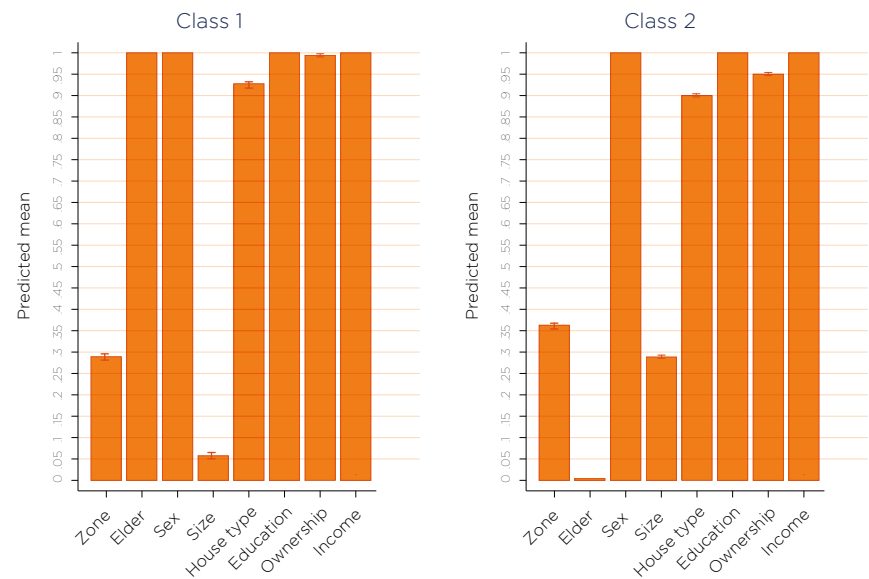


Figure A2.4 Sub-populations of poor households that use non-firewood (i.e. gas or electricity) in Peru

Case of Ecuador

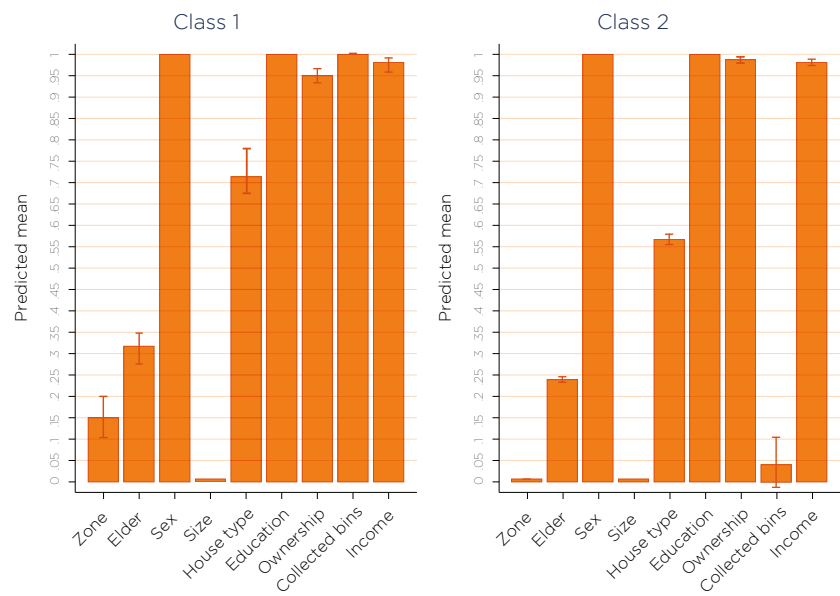


Figure A2.5 Sub-populations of poor households that use firewood in Ecuador

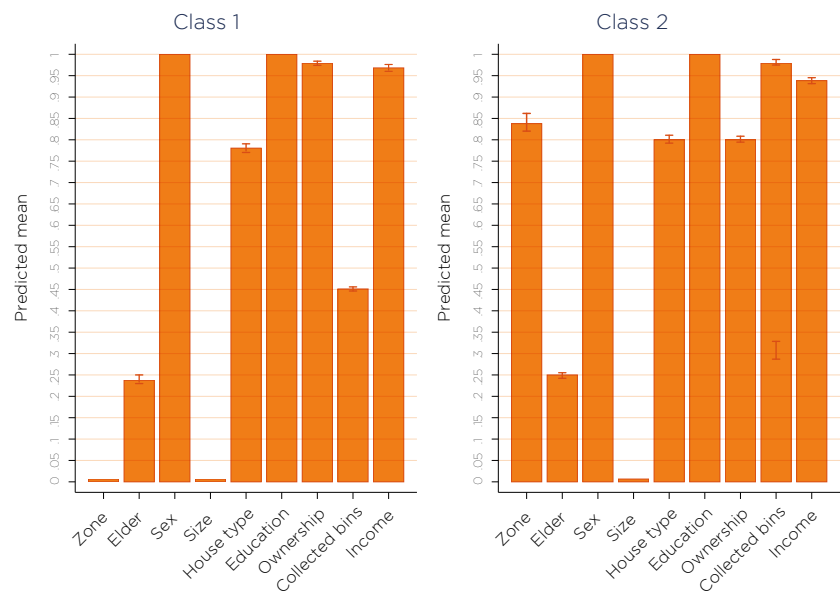


Figure A2.6 Sub-populations of poor households that use non-firewood (i.e. gas or electricity) in Ecuador

APPENDIX 3: SIMPLE LOGISTICS REGRESSION ANALYSIS RESULTS



In our logit model, our dependent variable is represented by a binary choice variable, such that it takes the value 1 if the household i has adopted modern cooking t ($y_{it}=1$) and 0 when it has not ($y_{it}=0$). The probability that the household i has adopted modern cooking at time t is written as p_{it} .

$$y_{it} = \begin{cases} 1 & \text{with probability } p_{it}, \\ 0 & \text{with probability } 1 - p_{it}. \end{cases}$$

p_{it} is represented through the following function that follows a logistics cumulative distribution

$$p_{it} = \Pr[y_{it} = 1] = E(y_{it}|x_{it}) = F(x'_{it}\beta)$$

where $F(x'_{it}\beta)$ is bounded between zero and one, x is a regressor vector and β a parameter vector with the dimensions $K \times 1$. The last equality holds as long as the density function describing F is symmetric around zero.

The logit model can be written more generally as

$$p = \Pr[y = 1|x] = \frac{e^{x'\beta}}{1 + e^{x'\beta}}$$

and the marginal effects of the j th regressor is defined as

$$\frac{\partial p}{\partial x_j} = F(x'\beta)[1 - F(x'\beta)]\beta_j$$

Our regressors x'_{it} for household i at time t are whether the household is in an urban or rural area, whether the household is a woman, whether she or he is elder, whether the household has more than 5 members, whether it is a house or an apartment, the level of education of the individual, whether the dwelling is owned, whether the bins are publicly collected, and the income level of the household.

Case of Guatemala

(1)

| VARIABLES | MARGINAL EFFECTS | |
|-----------------------|------------------|------------|
| Zone | 0.260*** | (0.0112) |
| Elder | 0.0790*** | (0.0103) |
| Female household head | 0.150*** | (0.0131) |
| Household size | -0.245*** | (0.0112) |
| Dwelling | 0.101*** | (0.0161) |
| Education | 0.224*** | (0.00784) |
| Ownership | -0.253*** | (0.0142) |
| Bin collection | 0.485*** | (0.0103) |
| Individual income | 0.000118*** | (3.80e-06) |
| Observations | 25,884 | |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A3.3 Marginal effects of the logistics regression of using modern cooking on a set of characteristics in Guatemala

Case of Peru

| (1) | | |
|-----------------------|------------------|------------|
| VARIABLES | MARGINAL EFFECTS | |
| Zone | 0.244*** | (0.00707) |
| Elder | 0.0611*** | (0.00610) |
| Female household head | 0.126*** | (0.00587) |
| Household size | -0.106*** | (0.00690) |
| Dwelling | 0.0164* | (0.00874) |
| Education | 0.0667*** | (0.00399) |
| Ownership | -0.163*** | (0.0222) |
| Individual income | 0.000163*** | (3.19e-05) |
| Observations | 42,862 | |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A3.3 Marginal effects of the logistics regression of using modern cooking on a set of characteristics in Peru

Case of Ecuador

| (1) | | | (2) | |
|-----------------------|------------------|------------|------------------|------------|
| VARIABLES | MARGINAL EFFECTS | | MARGINAL EFFECTS | |
| Zone | 0.221*** | (0.0136) | 0.210*** | (0.0122) |
| Elder | -0.0170** | (0.00852) | -0.0148* | (0.00799) |
| Female household head | 0.0310*** | (0.00768) | 0.0238*** | (0.00705) |
| Household size | 0.0979*** | (0.00765) | 0.0936*** | (0.00709) |
| Dwelling | 0.0529*** | (0.00619) | 0.0526*** | (0.00573) |
| Education | -0.0309 | (0.0204) | -0.0282 | (0.0188) |
| Ownership | 0.167*** | (0.00865) | 0.163*** | (0.00797) |
| Bin collection | 0.000268 | (0.000163) | | |
| Individual income | | | 0.000315** | (0.000154) |
| Observations | 9,423 | | 10,691 | |

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table A3.3 Marginal effects of the logistics regression of using modern cooking on a set of characteristics in Ecuador

APPENDIX 4: PRINCIPAL COMPONENT ANALYSIS RESULTS



We first run a Patent Composition Analysis (henceforth PCA) of all the characteristics that we found to be significant with respect to cooking adoption, for all poor households. The PCA allows to reduce the number of observations to keep only those that provide sufficient information. It does so by bringing highly correlated variables into different orthogonal plans. This is the case of our significant variables, for instance between living in an urban area and having less household members, usually due to smaller living spaces compared to non-urban areas.

With the estimation coefficients collected for each variable, we create a baseline by multiplying each coefficient by the relevant variable. We then create our index using the ratio of the baseline over the sum of all coefficients. The index is measured such that we have the sum of the product of each coefficient with the variable at the numerator and the sum of all coefficients at the denominator. We have a total of 8 variables. The index looks as follows:

$$\text{Clean cooking index} = \frac{\sum_{n=1}^8 \beta_n * X'_n}{\sum_{n=1}^8 \beta_n}$$

The objective of index is to estimate how likely is a person to lack clean cooking based on general variable used on household surveys. Many of the household surveys do not present precise questions on clean cooking, this methodology could help to estimate the population lacking clean cooking. In this report, we use the index to discuss the relation between the lack of clean cooking and the income. We found heterogenous relationship but all the cases we show that, among the lower income population, the increase of income increase the probability to access to clean cooking, however, in every case there is cap. It means in the different cases, we observe other variables impacting on this decision, especially above a certain level. This result is important to think about the limits of programs such as conditional cash transfers to increase clean cooking access.

Case of Guatemala

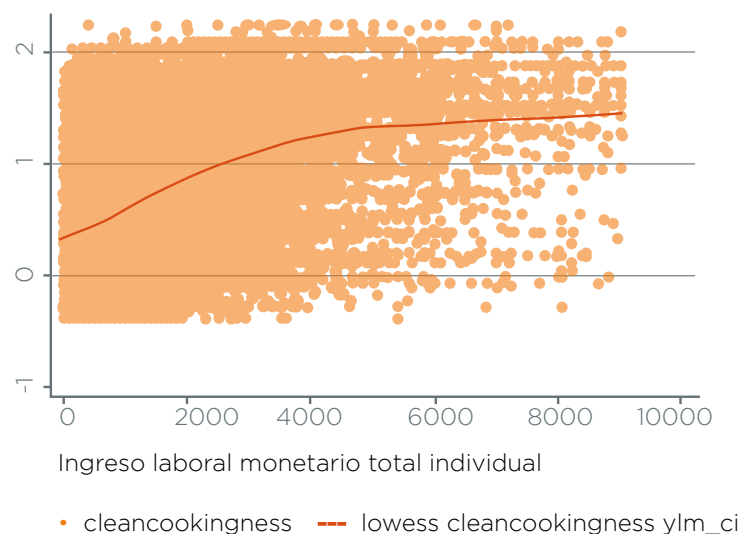


Figure A4.1 The evolution of the “Clean Cookingness” Index by individual income in Guatemala

Case of Peru

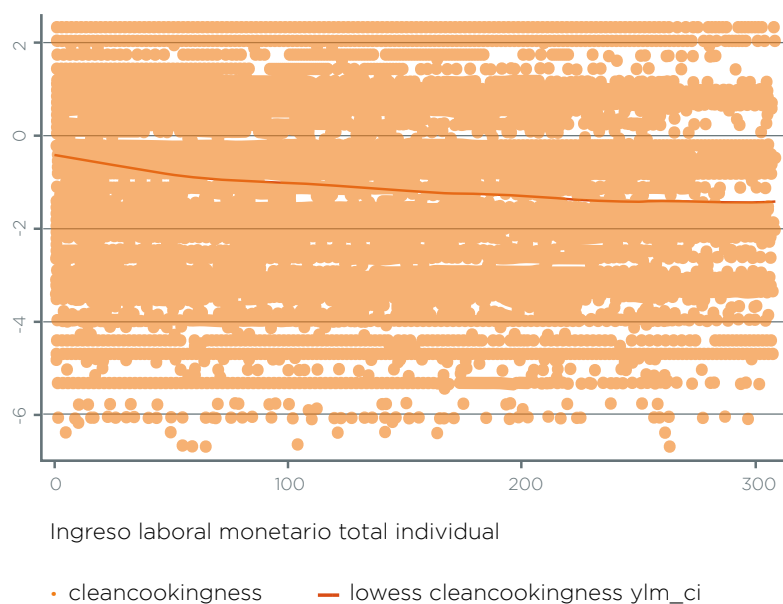


Figure A4.2 The evolution of the “Clean Cookingness” Index by individual income in Peru

Case of Ecuador

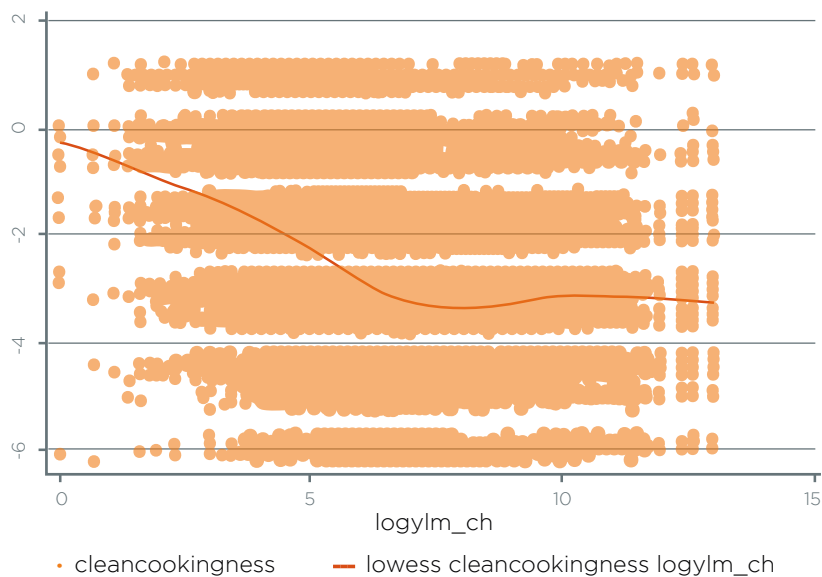


Figure A4.3. The evolution of the “Clean Cookingness” Index by individual income in Ecuador

APPENDIX 5: SEMI-STRUCTURED INTERVIEWS FROM FIELDWORK IN GUATEMALA



Semi-structured interviews conducted in Guatemala with 15 households from the communities of San Jose Poaquil in the Department of Chimaltenango on February 18 and 19, 2020. The selection of the households was based on being enrolled in the program of the NGO Puente (<https://www.puente.org.gt/>), which guided us to the households and put us in touch. This NGO primarily fights child malnutrition through the acquisition of an improved cooking stoves, amongst others, which households can buy conditionally on their attendance to a series of workshop. Workshops are focused on nutrition, hygiene, managing household expenses, health, cooking efficiently and making the best use of the improved cooking stoves, amongst others.

The semi-structured interviews were divided into six sections. The first one focused on the presentation and getting acquainted with the household member, who was in all cases either the mother, the grandmother or the daughter. When given the choice, we interviewed the person who reported to make the biggest use of the kitchen and cooking stove. The second part of the interview sought to gather basic information on the cooking stove. In the third section, questions focused on the use of the stove. The fourth part of the interview was dedicated to its adoption. Finally, parts five and six inquired about health and safety around the cooking stove, respectively. The template used in each interview can be seen in Box A1. Interviews were carried out in Spanish and in the local language with a translator, when necessary. They were also recorded. The interviews were first transcribed and then translated to English by a Guatemalan translation firm. Each question was only used as a guideline and was adapted, when necessary. Full interviews are reported below.

Box A2 offers a summary of the results of these interviews by focusing only on straightforward and comparable collected information. As can be seen, in all 15 households, the interviews was with a woman. Households have between one and seven children, and sometimes included several generations.

We distinguish between three types of cooking stoves here. The first one is the open wood fire. The second one is what we call the non-improved cooking stove, which is a homemade cooking stove that was built by a member of the family instead of a manufacturer, and hence which presents some flaws and would not tackle all the issues that a manufactured improved cooking stove would. For instance, smoke might be escaping from the pipe, or the combustion chamber might not be properly isolated. Out of the 15 households we interviewed, two had an open fire and hence no type of improved kitchen whatsoever, six households had a non-improved cookstove, and seven had an actual manufactured improved cooking stove. Some of the households with the improved cooking stove had received it through the program with the Puente NGO²³.

We also asked whether they bought their own kitchen, and for how much, or whether it was free. In some cases, there seems to have been another NGO²⁴ in the past that distributed cooking stoves for free. We also asked why they bought (or accepted) the new kitchen, whether they knew someone who also used it, whether they knew how to use it, where their fuel is coming from, whether they're still using the same pans and pots as before and what would they say are the advantages of these non-improved or improved cookstoves.

It is worth mentioning that for the sake of anonymity, the surnames of the interviewees have been removed, the first names replaced with their initial letters and their age replaced by an age bracket. Each household was given a portable rechargeable lantern that also works with solar panels and a crank as a thank you present for their time and participation in the interview.

23. We acknowledge that as far as the selection of households for interviews was made through that NGO, this might imply some bias in the answers of the interviewees when it comes to assessing the quality of the improved cooking stove, for example.

24. We have preferred to keep the name of that NGO confidential and therefore only refer to it as the 'NGO'.

1. Presentation

- Name, number of family members, what and how do you cook
- Did you buy your kitchen stove? Who had the idea to buy it? Why did you buy it? Was it expensive? Do you know someone else who also uses it? How long have you had it for?

2. Information

- Please tell us about the installation
- Who bought the stove? How did you know how to use it? Someone helped you to install it? How did you know how it worked?

3. Use

- Where do you get your fuel from? Which pots and pans do you use with it? Could you please show us? What is your daily use of the stove?

4. Adoption

- Which would you say are the advantages and disadvantages in terms of the kitchen stove usage?
- Have you noticed any change since you have started using it?
- Would you recommend this kitchen?

5. Health

- Have you noticed any change in your health since using this new kitchen (when applicable)?-
if not applicable, ask the same question about current stove

6. Safety

- Have you had any domestic burn or fire in the house since using this new kitchen (when applicable)- if not applicable, ask the same question about current stove

Nota Bene: in some cases, the interview does not necessarily reflect this format. This is because during the fieldwork we were accompanied by consultants we hired for a parallel fieldwork, who were doing research on the air pollution of the households through the use of PATS+. Their own work also consisted of a set of questions to collect information on the household habits and use of the cooking stove, which overlapped with our own questions. In these instances, we skipped our first interview questions and go straight to those that remain unanswered. However, the first part of the interview, that is with the consultants, is still included here. In other instances, the order of the questions might have changed and some sessions skipped, when relevant. As these are semi-structured interviews, some freedom was granted in terms of the evolution and structure of the conversation.

Box A5.1 Interview template

| House no. | No. children | Stove type | Did you buy your stove? | Who had the idea to buy it (i.e. the stove)? | Why did you buy it? | Do you know someone else who has the same? | Did you know how to use it? | Where is your fuel (i.e. wood) coming from? | Do you still use the same pans and pots as before? | Which would you say are the advantages of this new stove? | Which would you say are the disadvantages of this new stove? |
|-----------|--------------|-------------------------|-------------------------|--|---|--|-----------------------------|---|--|---|---|
| 1. | 4 | Non-improved | Yes | Herself | Safety, fire | Her mother | Yes | Buy, collect | Yes | Less wood, bigger size | It could have a floor around |
| 2. | 2 | Non-improved; LPG | Yes | Herself | Smoke, heat, more efficient for tortillas | Her grandmother | Yes | Buy | Yes | More heat, multi-purpose, safer, less cold than open fire outside, less insects | Smoke still comes out |
| 3. | 5 | Open fire | n.a. | n.a. | n.a. | n.a. | n.a. | Buy | n.a. | n.a. | n.a. |
| 4. | 4 | Open fire | n.a. | n.a. | n.a. | n.a. | n.a. | Buy, collect | n.a. | n.a. | n.a. |
| 5. | 3 | Non-improved | Yes | Herself | Safety | No | Yes | Buy, collect | Yes | Multi-purpose, more resistant, safer, less eye redness | Smoke escapes, deficient chimney, table low/unsafe for children |
| 6. | 5 | Improved | Yes | Puente | Smoke | No | No | Buy | Yes | Less smoke, looks nice, larger quantities | - |
| 7. | 1 | Improved | Yes | Puente | Smoke | No | Yes | Buy | Yes | No smoke | - |
| 8. | 5 | Non-improved | No | NGO | Smoke | Neighbors | No | Collect | No | Less wood, multi-purpose, less headaches, eyes less painful | Old, deficient, no guarantee |
| 9. | 2 | Improved; LPG | Yes | Herself | Smoke | No | No | Buy | Yes | Less smoke, less phlegm | - |
| 10. | 3 | Non-improved; open fire | Yes | Herself and her husband | Burns | Her mother | Yes | Collect | Yes | Less wood, less burns | - |
| 11. | 7 | Non-improved | No | NGO | Smoke | No | No | Buy | Yes | Less burns, less smoke | Chimney broken, no maintenance, smoke escapes |
| 12. | 3 | Improved | Si | Puente | Smoke | Her neighbors | Yes | Buy, collect | Yes | Less wood, safer for children, less smoke, eyes less painful | Heat is concentrated at the front, no heat at the back |
| 13. | 2 | Improved; open fire | Si | Puente | Smoke, wood saving | Her sister | Yes | Collect | Yes | Less wood, less smoke | Smoke escapes |
| 14. | 1 | Improved | Si | Puente | Wood saving | No | Yes | Buy, collect | Yes | Less wood, less smoke | - |
| 15. | 3 | Improved; open fire | Si | Puente | Safety, fire | A family member | Yes | Buy, collect | No | Faster, less smoke, safer, less burns | Had to move the kitchen as the chimney was too hot |

INTERVIEWS

E- Interviewer

E2- Second Interviewer

E3- Third Interviewer

P- Interviewee

P2- Second interviewee

I- Mayan language interpreter

INTERVIEW 1

1. PRESENTATION

E: How and who do you cook with?

P: With firewood

E: Here, you put it here?

P: Yes, here.

E: You put the firewood in here, super. Is this your main cooking area?

P: Yes, for cooking and for making tortillas.

E: Oh, excellent! Where do you do it?

P: Right here as well, a liquid called lime is applied on this, before we used the, like, mud, it was made of mud, earth, mud, but then we had the possibility to build this, then on this one you can also make tortillas.

E: Did you build it? This one?

P: Yes, there is a man who specializes in house construction and builds this.

E: It's very good. Ok, super. This cooker you have here, how long have you had it?

P: 3 years.

E: And what did you have for cooking before?

P: I only had 2 blocks and the skillet I told you about and 2 iron rods for cooking, I had no pipes, the smoke would spread.

E: Was it like this, in the open here?

P: It was in the open, I didn't have a kitchen yet, it was in the patio.

E: It was in the patio in the open, it was an open fire in the patio.

P: Yes

E: So, this cooker, you bought it, right?

P: This one, yes, all the materials to build this one, everything was bought.

E: Ok. And, how did you get the idea, or who had the idea, how did you go about transitioning from this to acquiring this cooker?

P: Since this one, we still didn't have the kitchen, we only had the 2 bedrooms and didn't have the possibility to build yet so afterwards, it was a dream for us to have one of these because, where we lived before we rented the house and it had one of these, so my husband and I liked it and...

E: Oh ok, right, so the place you were renting before had this, and that's where you saw it and

you liked it very much and thought, "in our next future house we would like the same." That's great. So then, of course, you made the decision together in a practical way. And is the cooker expensive?

P: It is a little, because of the design, the manual labor.

(INTERRUPTION, INTERVIEWEE TENDS TO VISITORS)

E: And do you know anyone else who also uses this cooker? Or did you know someone before you had it?

P: Yes, my husband's grandmother, most of them have this one but I didn't, I only had a skillet like this, on an open fire.

E: Oh, so you had this, but not the entire design.

P: Yes, the design came from theirs as well because they have this, yes.

E: So, you saw it there and were inspired. Ok. Super, thank you. And, one question, what is that?

P: Gas stove.

E: Have you had it long?

P: About 4 years.

E: So, you had the gas stove before you had this one?

P: Yes.

E: And how did you get it?

P: It was a gift from a family member, who didn't want it anymore and gave it to me.

E: And did it work?

P: Yes.

E: You tried it, used it, operated it?

P: Yes, yes, I use it sometimes, when I don't have firewood, I use gas.

E: Do you have a pump?

P: Yes.

E: But you only use it once in a while.

P: Yes, once in a while.

E: More as a replacement.

P: Yes.

E: Is it expensive to buy gas?

P: The price varies between 115 and 125 per container.

E: And you prefer using this instead of gas?

P: Yes.

E: How do you see it? I don't know, I don't know...

P: This produces heat, sometimes, during the cold weather this keeps the kitchen warm, it's cozy, but not with that one. It stays cold.

E: And maybe, I guess this one is much bigger than this one, right, so I see you are preparing several things at the same time.

P: Yes, because with this one you can take advantage of the firewood, I use it to cook, beans, corn for making tortillas, but with that one it's just, if you use it quickly the gas runs out quickly, so I prefer to use this one and use it for many things.

2. INFORMATION

E: So, when you bought this one, did someone come to install it, or how did you know how to use it, how did you install it? Because it's big, it's heavy isn't it?

P: First you build this with blocks that surround it, afterwards you fill it with mud to keep it warm, and other types of material called bricks, also to keep the heat, since most of it is mud, all of this is mud, and this is only the surface, it's not all made of cement, most of it is made with blocks.

E: And did someone help you?

P: Yes, it was built, like building a house, by a mason.

3. USE

E: And this for example, did you know exactly how to use it with firewood, how to operate it?

P: Yes, because I'd seen how it was done.

E: With the grandparents.

P: Yes.

E: So, you use mostly firewood, do you buy it or search for it?

P: I buy the firewood.

E: Is it expensive?

P: Now it's, we buy a load, and the load has 80 logs, and its price is 80 quetzales.

E: And would you say you use the same amount year-round?

P: Excuse me?

E: Year-round, do you always use the same amount of firewood?

P: Yes.

E: You always know that you buy, for example, 80 per month.

P: I use almost 2, let's see, about 160 logs per month, because for bathing we use something like a sauna so we build a fire, temascal, so we use firewood for that, we heat-up the water for bathing, so that's the amount of firewood I use per month for cooking and for...

E: And 4 people live in the house.

P: Yes.

4. ADOPTION

E: Super, thank you. And let's see, in general, now I know you have been using this for a long time, maybe you don't remember what it was like before with the open skillet, but what would you say are the biggest advantages, what would be the disadvantages, and in general did you notice any big changes when you changed what you used for cooking?

P: Well the advantage was, like I said, the heat spreads throughout the house because when you're here you feel warm and calm, but with the open fire it's not so, it escapes and produces too much smoke, this helps in part with the pipes but only partly, the disadvantage is that it still produces smoke.

E: But it doesn't produce it now, does it?

P: No, it's when you light the fire that the kitchen is filled.

E: And it's covered there, it's closed off, it retains heat but also some smoke...

P: Yes, sometimes this doesn't help much when there is a lot of wind it (the smoke) doesn't rise, it returns and comes back inside and spreads. The advantage is, as I said, taking advantage of all the heat for cooking, boiling water for consumption and making tortillas, that is the advantage of this, it was difficult with the open water because you had to put the skillet on it first, make tortillas, and then cook.

E: And what are you cooking now?

P: This is called a stew.

E: Oh, yes.

P: It's made of several types of cooked meats, but this takes a while, this takes a while to break off the bone, so it uses a lot of firewood, but still it's a very delicious meal.

E: It looks delicious, it smells delicious.

P: You can try some later.

E: No! (laughter).

P: Don't worry about it, it would be my pleasure.

5. HEALTH

E: Thank you. Ok. Another thing, as a change, for example I am thinking regarding your health, you said that there is still smoke, but more regarding physical things about yourself, how did you feel, was there a change, you think, since you had an open fire outside and changed?

P: Yes, it's better because there is a lot of wind in this area and the kids and I would get sick with a cold more frequently, instead this helps a little because it protects us so that not too much wind comes inside, that is the advantage.

6. SAFETY

P: Well with this there are less accidents with the kids, because they can sit there and eat and the pots are secured, unlike with the open fire because the iron rods sometimes, since we used iron rods to hold the pots they could fall over by accident, so with this one it's more...

E: It also feels more...

P: Yes, safer with this, yes.

E: During the summer do you use that one more, because that one generates heat?

P: Yes, this didn't have the transparent sheet because it was too cold, so we decided to change it, but now it's hotter, we have to return...

E: And do you use the gas one more during the hot weather?

P: Sometimes, yes, because now it's a little, you can still make tortillas, but there are times like in March, in April, it gets very hot, it's unbearable so I prefer to make tortillas in the morning and then reheat the tortillas, yes.

E: Have you ever had an accident with the gas one, has that never happened?

P: No, thank God no, I have heard about them yes, but not in my case, not here.

E: Last question, do you feel like maybe, because now I see that there are some flies and everything, that maybe before with the open fire and the smoke...

P: There were more!

E: More flies?

P: Yes. The problem is that, because we live near a, how do you say it... where they keep animals.

E: A farm?

P: So, the heat attracts all the flies, even if we keep everything clean it's the same because there's a farm nearby.

E: So, you're saying that the open fire with the heat...

P: Yes, same with the food, but now we can close the door a little.

E: It's more closed off here and everything goes in there. Ok, super. I think I'm done, thank you very much, it was truly very interesting. Is there anything you would like to ask us or share with us that maybe...

P: Regarding the cookers? No, then no.

E: Ok. This is very good, what you have done here is very nice and super big, you can do many things, I didn't know you could put the tortillas on top but that you need to use something special so they won't stick, right?

P: Yes, and at the same time this helps because you can sit around it, like a small table, to eat.

E: Ok, thank you very much.

P: Would you like to try?

E: (Laughter) We don't want to steal the family meal!

INTERVIEW 2

1. PRESENTATION

E: Could you show us where you cook, where is it, please?

P: Yes, you may come in.

E: Are these your children? What is your name?

P: Me? María Roselia.

E: How many children do you have?

P: Five.

E: It looks like you have more because the neighborhood kids came over!

E: Is this the cooker you use?

P: Mhm.

E: Ok, perfect. And, how and who do you cook with, what do you use to cook?

P: Firewood.

E: Firewood? Is the firewood here too?

P: Yes.

E: In this part?

P: No, there it is.

E: It's outside, ok. And regarding pots, your pots are here, right, these are the pots you use?

P: Yes, those are the ones.

2. INFORMATION

Tell us what the installation was like?

Who brought it? How did you know how to use it? Did anyone help you install it? Did you know how to use it?

E: Ok, perfect. And this cooker you use, did you build it?

P: Mhm.

E: Yes, you put everything here.

P: Yes.

3. USE

Where does your fuel come from? What equipment do you use with this one? Can you show us? Could you tell us what its daily use is?

E: Ok. Perfect. And the firewood you use, do you buy it, do you search for it?

P: Some I buy, I buy it, yes.

E: And search for it too? Right?

P: Yes, both.

E: And how do you decide whether you buy it or search for it? Does it depend on whether it's expensive?

P: It's more expensive. Yes.

E: Ok. And so, this is the cooker, it's the only one you have in your house, right?

P: Yes.

E: Ok. And during your typical day, right, how many times do you use it?

P: Three.

E: Three times. And what do you use it for, just for cooking?

P: Yes.

E: And for heating water or things like that?

P: No, I have my temascal.

I: That's what the other lady said.

E: May I see?

P: There it is.

P: I build it and heat my water here.

E: I don't understand how they work.

E2: They heat up the air inside and then you heat up the water inside, kind of like, sort of like a sauna.

E: And how do you heat up the place?

E2: With fire inside.

E: With fire, firewood; the firewood?

P: Mhm.

E: And where do you put the water for heating?

P: There, because that's where the grill is.

E2: They do the same thing in Finland; this is a traditional sauna.

E: Yes, yes, they have those too. Ok I understand, very well, super.

E2: Heating the rocks is the key to all this (laughter).

E: Should we go back out there to record?

E2: Yes.

I: It's very asphyxiating for me.

E: It's very hot here, isn't it? It's because of the fire, right?

P: Mhm.

E: And this is, it's your bedroom, your husband's and your children's as well, you all sleep here, right?

P: Mhm.

4. ADOPTION

P: No.

E: No? It's practical, easy, you can cook several things?

P: Yes.

5. HEALTH

6. SAFETY

E: Ok. Have you ever had an accident with the fire, do the children get close?

P: No, no, they don't get close. I tell them when I'm going to cook something.

E: So that they won't get close.

P: Yes.

E: Ok, super. I think on my part... I'm thinking but... this doesn't have...

I: No. It's an open fire.

E2: And to make tortillas, do you also make them there? You make them all at once and then

heat them, so that they can warm up?

P: Mhm, yes.

E: And if there were another type of cooker, would you be interested? An alternative way of cooking? Another type of cooker, or not?

I: She would like it but doesn't have the economic means to build or buy.

E: And if you would like one, what would you like? Could you ask what disadvantages it has?

I: It's like I mentioned a while ago, sometimes it's a little hard to get her to answer, but she says yes, that what she doesn't like is the smoke because of the kids and that it uses too much firewood, and that is what would motivate her to build something else, however she doesn't have the economic means to acquire.

E: But if there was a cheaper solution, she would be willing to adopt it, right?

P: Yes.

E: If it's not too expensive, if it's easy.

P: Yes.

E: Ok.

P: But we don't have...

E: But maybe in the future.

P: Yes, later, we will do what we can.

E: That's why we are here, we are curious to see what we can do to improve the cooker you use.

E2: If you could change the cooker, what would you want from the new cooker? What is missing from this one?

I: When you say cooker, you mean only...

E2: The fire and what goes on top.

E: If you could change, what would you change, what would you prefer to have?

P: Griddle.

E2: And, if you had fires or something like that, how many, if you had like, certain places to put the pots, how many...

P: The griddle?

E2: Yes, of course, the griddle. I meant like fires, if you had certain places to put the pots? How many pots do you usually cook at the same time?

P: About 3

I: Yes, because she can't do everything at the same time here.

E: Here it's just one pot at a time?

P: Mhm first I'm going to cook my food then make tortillas, or first make tortillas and then make my food.

E2: And approximately how many pots do you cook per day?

I: She says she cooks 3 meals a day, but for example when she makes her coffee and food in a small pot, she puts the coffee in one here and another one here, holding them with these rods.

P: Mhm.

I: This is the skillet they use. So, they put this here to make tortillas.

E: That gets hot, right?

I: There's no fire right now, it's cold.

E: You have to be careful to not get burned. The firewood you buy, approximately how many logs do you use per month?

P: Four boxes.

E: And how much is a box?

P: One box costs 70 quetzales.

I: Every load has 80 logs.

P: Mhm.

E: Thank you.

E: Ok. I think this is enough. Thank you very much.

P: Thank you.

E: María Joselia?

P: Roselia

E: María Roselia. Thank you, truly.

INTERVIEW 3

1. PRESENTATION

(Friendly conversation)

E: How many children do you have?

P: I have five- four

E: And how old are they?

P: This one is five, this one is four.

E: Can they eat candy? It's for sharing, you need to share.

E: What is your name, please?

P: D.

(Friendly conversation and laughter)

E: Delfina, this here is your cooker, your kitchen?

P: Yes.

E: This is where you cook.

P: Yes.

E: Everything?

P: Yes, everything.

2. INFORMATION

Tell us what the installation was like?

Who brought it? How did you know how to use it? Did anyone help you install it? Did you know how to use it?

E: Ok. You built this? With your husband, or by yourself?

P: My husband and I.

E: You set it up.

P: Yes.

3. USE

Where does your fuel come from? What equipment do you use with this one? Can you show us? Could you tell us what its daily use is?

E: You cook your food here. What equipment do you use?

P: This one.

E: This, the pot, and you use this to put... ok. And cook food. And do you heat water as well?

P: No.

E: Not water. Ok. And you use, what do you use for cooking, with what?

P: With firewood.

E: Oh, with firewood, and where is the firewood?

P: I will...I don't know what it's called.

E: You can show me if you like. For now, you use this. What is it called?

P: Chicuya.

E: These little sticks are Chicuya.

P: Yes.

E: But you didn't buy that, you searched for it?

P: We searched for these. When we have pisto, we buy firewood.

E: When you have what?

I: Money.

P: Yes, money.

E: What's the word?

I: She said pisto.

E: No, that way I learn as well. Is firewood expensive?

P: The load costs 70.

E: So, when you have pisto you use firewood, otherwise you go search.

P: Yes, we search for this one, see?

E: Is it too far to look for that?

P: Very far.

E: How far?

P: Two hours.

E: Two hours to get there? And two hours...

P: No, one hour, we search and then come back.

E: Do you search alone?

P: No, my husband goes; otherwise my daughter comes with me.

E: Oh ok, so you always travel there with someone, right?

P: Yes, to get there.

4. ADOPTION

E: Ok super. And, how many times a day do you use your cooker?

P: Three times.

E: Three. For every, like lunch, dinner, breakfast, and so forth?

P: Yes.

E: You don't use it in between, right, just when you cook?

P: Yes.

E: And are there some things that bother you about the cooker? Any use disadvantages?

I: The smoke and that it uses too much firewood.

5. HEALTH

E: Too much smoke. Right? And, what is the impact that bothers you the most. Like breathing it, or on your skin... the children sleep here too right, you all do?

P: Yes, we all do.

I: She says it has affected her with the children because since they sleep right here, then they go to sleep early, and when they, in other words, they go to sleep but she continues cooking, so they get cold, they close the door and it gets filled with smoke in here. And it has given them many problems in general.

E: Would you like to have another one?

P: Yes.

E: What would you like to have?

P: I would like to have a griddle.

E: Is it expensive?

P: Yes, it's expensive.

E: How much is it? Do you know the price?

P: I haven't really asked much, but I've heard about 350.

E: Do you know people who use the griddle? Do you know friends, neighbors who use a griddle?

P: Yes.

E: Which do you think are the advantages of the griddle?

P: That makes the smoke go out.

E: And the griddle...

P: Makes things faster, the coffee and the tortilla, uses firewood.

E: How do you know that, all this?

P: What happens is that my mother has a griddle.

E: Your mother?

P: Yes, she has a griddle.

E: So, you have seen how she uses it, less firewood, less smoke...

P: Yes, she makes food, makes her tortilla, makes tortillas.

E: Where does your mother live?

P: Up there near the school.

E: Oh, right, we passed it, right?

6. SAFETY

E: Have you ever had any accidents with the open fire, or with the kids, burns, a fire or something like that?

P: No, no, I'm always careful.
(Friendly conversation)

INTERVIEW 4

1. PRESENTATION

P: L.

E3: Her mother had to go because she had a...

P: Yes.

E3: So, she left us the equipment here, I don't know if you, do you cook?

P: Yes.

E3: I don't know if you want to interview her? Yesterday, her... was it your mother?

P: Yes, she's my mother.

E3: Your mother answered some questions but now P and E are here, and they would like to know a few more details about other things, so do you think you have a few minutes to answer some of their questions?

P: Sure.

E3: Ok, well, perfect.

E: Thank you, F. How old are you?

P: [She is states to be between 20 and 30 years of age, censored for privacy]

E: Do you live here with your parents?

P: Yes, I live with my parents.

E: And how many live here? Do you have brothers or sisters at home? How many?

P: Sisters, in total I have... the ones living at home are, yes, three.

E: Ok. Is it your parents and you?

P: We are 6

E: Ok, so besides you and you parents, there are three brothers or sisters or family members, a total of six.

P: About eleven... I have sisters-in-law, brothers that are separated as well.

E: And they all live here?

P: Yes, they are separated.

E: Oh, ok.

P: Yes, they don't live with us.

E: Ok, so six live here then.

P: Yes.

E: Ok, super. So, tell me, what do you cook with, is this your cooker?

P: Yes.

E: Is it the only one you use? What do you use?

P: Yes, that's right.

E: And you use it for food right, to prepare the food.

P2: For food, for the tamales, everything.

P: Yes, we prepare everything.

E: And this cooker you have, how long have you had it? Do you know?

P: About four years.

E: 4 years. Did you buy it? Do you know if they bought it?

P: I think so, they bought it.

E: Do you know how they decided to buy the cooker? Where they got the idea?

P: I think a group also came to talk to them about that, and that's how they decided to buy it.

E: Do you know if it was expensive?

P: Excuse me?

E: Was it expensive? Is the cooker expensive?

P: I don't think so.

E: Anyway, it was four years ago, a long time ago.

P: Yes, we need another one already (laughter)

E: And do you, do you know anyone else who also uses it? Or maybe you bought it because you knew someone who had it and thought "oh this is good", and saw how it was used, or...?

P: Mmm... long... long ago this wasn't used, clay skillets were used, that's what we used before, but I think they saw a lady that was using it and that's when... almost the entire family using this, most people are using this, but before this didn't exist here.

E: And the person who came to talk and tell you about it, what did he say about this cooker?

P: I don't really remember (laughter).

E: Like, "oh, this is a good cooker", or "you can buy it and it's not too expensive", or...

P: Yes, he talked about that and how it's very bene... well it's very... it's convenient for us because I think that because of the smoke, there was too much smoke, you know.

E: Specially because of the smoke... yes it was a long time ago... it's something else you don't remember much, but it's not too important.

P: Yes.

2. USE

E: So, tell me, for the cooker you use, the fuel you use is firewood, right?

P: Yes.

E: And the firewood, do you buy it or search for it?

P: We buy it and search for it too, both.

E: How do you decide? What does it depend on?

P: Excuse me?

E: How do you decide if you buy it? Does it depend on the money? Or does it depend on... or is it a mixture, you do both. How do you decide if, when you run out, whether you go buy it or search for it?

P: Oh, we buy it.

E: So, in general, you usually buy it.

P: Yes.

E: Ok.

P: Because here there almost isn't any...

E: Ok. Do you know if it's expensive, or approximately how many loads of firewood you use per month?

P: Per month about...mmm... how much, about three loads, right?

P2: More...if... only you guys use almost about two loads weekly.

P: About eight loads per month.

E: Approximately eight loads per month?

P: Yes.

3. INFORMATION

E: I don't know if you remember when you got this one, when they started building this cooker, how did it happen, did someone come to install it?

P: Yes, they came to install it.

E: Who, who came?

P: The ones who showed us this.

E: The...

P: The... like you, they came to talk, and a group came.

E: So, they themselves came, installed it, showed you, they explained how to use it.

P: Everyone went with the person, he taught everyone, and all the people were there and that's where.

E: Oh, ok, you held like a meeting, "look everyone come and I'll explain how it works".

P: It was a big area.

4. ADOPTION

E: It was a large, communal area. Ok, perfect. And... I don't know if you remember what you used before, well the fire, you used open fire before, right?

P: Mhm.

E: And now that you have this, what would you say are its advantages or disadvantages for cooking? Have you noticed anything about how useful it is, or, I don't know, maybe what things were better with the previous one?

P: Oh, now we can cook and make other things besides just cooking, we can cook here, and boil the tamale at the same time, and also make tortillas so as not to waste the firewood.

P2: It's better than the clay skillet. That's what she's asking.

P: When you arrived, were they using this?

P2: Huh?

P: When you came, were they using this?

P2: No, when D [Family member] bought the griddle with your grandfather, that's the one we use, afterwards they came to set this up.

P: So, my mother was using that one before.

P2: Yes. When I arrived, it was already there.

P: Oh.

E: Yes, oh (laughter) ok then, the biggest advantage is its multiple uses.

P: Yes.

E: Do you see any disadvantage?

P: Something I dislike...mmm it's just that because of the length of time we've been using it almost all of the smoke comes from there where the little holes, the grates are.

E2: It doesn't escape.

P: Yes, that's what I don't like much anymore.

E: Oh, ok.

P: Yes.

E: You mean the smoke doesn't escape through the chimney?

P: Mmm... because it's been a long time it's escaping through there.

E: It wasn't always like that, but with the passing of time.

P: Yes, as time passes it's like it's wearing down.

P: Mhm. Yes.

E: Ok. And, but in general, would you recommend this cooker? If you had another family or person, would you say this is good, would you recommend it?

P: Yes, it's much better than using the, what's it called, the clay or aluminum skillet, yes.

E: And... but before you had it, do you know if there were other family members who had it as well?

P: No.

E: You didn't know anyone; it was truly new.

P: Yes.

E: You didn't know of anyone else who...

P: No

E2: And have any relatives asked you about it?

P: Excuse me?

E2: I mean afterwards do you know of anyone who has also adopted using this one.

P: Yes.

E2: I meant like if your friends or family or something like that someone who installed it after as well.

I: If someone saw this model this one and if someone else built it just like yours.

P: Yes, right now most people, because they saw its health benefits then, almost the majority of them have it. They almost don't use the clay or aluminum skillet, almost everyone is using it.

5. HEALTH

E: And tell me something else, do you think that... do you remember what it was like to use the other one compared to this one, regarding health of physically, any changes?

P: Mmm...yes, well I remember that the patojos would often get sick because the smoke made them cough...

E: Who? I'm sorry, who?

I: The little brothers and sisters. Patojos, kids.

P: It made them sick with a cough, or they would get something else, or else their eyes would swell up because of the smoke, it affected them a lot.

E: But where was the open fire before, before you had this?

P: It was made of mud.

E: Where was it?

E2: Was it here as well? Or...

P: No, down there, it's just that we changed it.

E2: Oh, right, right.

P: Yes, the kitchen was down there before.

E2: Which was in the open.

E: And was it just one section with the bedroom, or not?

P: No, the house was here before, and the kitchen was over there, and the things were here. Since the family has grown now...

E: Right, but the kids were there near the smoke from the cooker anyway.

P: Yes.

E: Even if they didn't sleep in the same section, still the fire...

P: Yes, since the kids run around there, they would breathe in a lot of smoke.

E: And was it closed off? Was the fire closed off or...

P: It was closed off, but my father had a sheet, going up so that the smoke would go out.

E: I understand.

P: Yes.

6. SAFETY

E: And... last question on my part, regarding accidents at home, any at all? Did something happen in the past, a fire or a burn from the open fire that happens less often now? Or have you had any accidents with this new cooker?

P: Before, the patojos would pull the firewood from under the pot.

E2: Really? (laughter)

P: Yes, they pulled the firewood and would burn themselves.

E: Who? The chicks?

E2: No, the kids.

E: Oh, the kids! (laughter)

P: Not the chicks! (laughter and friendly banter)

E: Oh right, so the kids would play with the...

P: Yes, they would play with the firewood there and would burn themselves, but not anymore because we don't let them get near.

E: You don't let them get near or is it also safer?

P: It's also safer. It's inside and they don't put their hands in, because before they would just pull and that's it, yes.

E: Ok. Thank you.

(FRIENDLY CONVERSATION)

E: Ok, on my part I think I'm ready, I have no further questions. I don't know if maybe, do you have any questions or comments or things you would like to say? Or...

P: Yes, I would like to know with this, what are the benefits we can expect later, and will we know if they are actually sick? Or I don't know what would happen.

E: It's just that, that's a good question, I'm glad you asked. Actually, the people that came here a long time ago for this, they are a different group, right? Of course, there are many people interested in this cooker system. With our team, we are measuring the contamination levels in the air.

E2: With their equipment.

E: Right, to check that. With E, we are here to see like, ok, with this new cooker, which are truly the advantages and disadvantages of this cooker and try to improve it as well.

E2: Of course, from your point of view.

E: But we want people to tell us, right? We need to know things like what you said, "look, this was good before, but now the smoke spreads". What we are thinking for the future, for you and for other homes, is that there is a problem with the length of time it's used. It works fine at first, but now it spreads. Now, the advantages that you put the tortillas on top, for example. Those...are ideas for improvement, a reality. But if we don't come to ask, if people don't tell us...

P: You have no way of knowing (laughter).

E:...we have no way of knowing. We have some ideas, ideas because we have read about another case or other places where it is used, but we would rather come and ask you. That's why, if you have any other comment you can think of like, "oh wait, I need to tell you this..."

P: That was my only question.

E: You can share with us.

E2: Thank you.

E: Thank you.

INTERVIEW 5

1. PRESENTATION

(Friendly conversation)

E: So, tell me, regarding your cooker, you were saying there are some things you would like to improve. You were telling me about it... would you like to stop?

P: Let's go to the shade, please.

E: Of course, of course, right. Yes, yes. You were telling me about the cooker, of course, that you would like for it to be taller because of your brother.

P: Yes.

2. USE

E: Because he touches it and doesn't realize the danger. And what is... you said there was something else?

P: Yes, that I wanted a small stove. I have thought about buying one and stuff because sometimes he asks for his milk with cereal, and we have to gather and light the fire and to do that takes about 10 minutes for it to warm up and for the firewood to light up completely. But with a stove, you just turn it on and that's it. We are thinking about buying one with my family, but we only think about it over and over and never reach the goal.

E: Is it expensive?

P: It's about 1,800, I think.

E: And what type of cooker is that?

P: Uh... one of those stoves from [NGO] or from...

3. SAFETY

E: Oh, with electricity.

P: Yes, with electricity or gas, yes, right. We are thinking about it because lately...he starts to... because before he wouldn't move at all and he would stay by himself on the bed and not do anything. But God willing, now he moves his hands, he moves his feet, he talks. It's not like before and we are grateful to God because of that, and we are scared that he will grab the firewood and there...

E: Of course.

P: Yes, and it's not just that, it's also that... because he stays sitting there, he gets warm...

E: Yes, and you have electricity here, right?

P: Yes, we have electricity.

4. ADOPTION

E: And what are the other... ok, but...uh... besides your brother, what would be... (interruption). But tell me, what were the other things you wanted me to... (interruption) Uh, what were the other things... besides your brother, there are other reasons, because F was telling me that you were thinking of buying a gas or electric stove, but mostly because her brother who can now like, he's older and touches things, but that it costs about 1,800 or something like that, but you were telling me that maybe there were other advantages, other reasons why you would like to change his, right, the cooker.

P: Yes, so I could quickly prepare, for example, his milk, the milk, because it takes us about fifteen minutes or more to gather, and he wants it quickly.

E: Is it slow?

P: Yes, it's slow.

E: Oh, ok.

P: It's mostly because of him that we want to change the...

E: Anything else you can think of or... other reasons? Besides his safety or avoiding accidents.

P: Yes, because we are thinking about that because we love him very much and don't want anything to happen here. We don't want anything to happen to him, that's why we're thinking about that. God willing, we figure out how to pull through, but we will change it.

E: Plus, gas stoves don't release any smoke. Did you know that? That gas and electricity stoves don't release any smoke, zero smoke.

P: Yes, they don't release any.

E: Because you told me that this produces, right? Anyway...

P: Yes, a little is produced, because he's always sitting there, he warms his hands, so he doesn't sit here, but since, God willing, we are taking him to his therapies, and he stands here and grabs the firewood...

E: (Laughter), but he also sees the color of the fire, and then...

P: Yes.

E: Ok. Ok thank you very much F. I think we're done here; it was nice meeting you and thank you so much for your time, I'm sorry if we interrupted your day a little.

INTERVIEW 6

1. PRESENTATION

E: So, uh, miss, how many people live in your house?

P: Seven.

E: Seven.

P: Yes.

E: It's you, your husband and the rest are your children?

P: Yes.

E: Ok. So, this is the place where you cook, right? This is your cooker?

P: Yes.

E: Is this the only place where you cook, right here?

P: Yes.

E: Your cooker is nice, it's very pretty.

P: Yes.

E: And how long have you had this cooker?

P: One month.

E: Oh, it's very new. You bought it a month ago?

P: Yes.

E: And who bought it, whose idea was it to...?

I: This is the one [NGO] gave them.

E: And what did you use before?

P: I used the same space, there's the griddle, see?

E2: The one that's disassembled there.

I: But on the ground.

E: Oh, on the ground, so it was an open fire.

I: Exactly.

E: So, you participated in the entire training program?

I: She is currently receiving the training.

E: She is. Oh, ok. Super. Ok, and before she entered the program in order to acquire this cooker, did she know anyone else who had it?

P: No.

E: You hadn't heard about it?

P: No.

E: You didn't know about the cooker?

P: No.

2. USE

E: And what do you use to cook? Do you use firewood?

P: Yes, firewood.

E: And where does the firewood come from?

P: We buy it by the load.

E: Is it expensive?

P: By the load.

I: But is it expensive?

P: By the load.

I: No, we mean, how much does it cost? Does it cost much?

P: It costs 150 per... per load.

E: Per load.

P: Yes.

E: And you never go search for it, you always buy it, right?

P: We always buy it.

E: And when you bought the cooker... do you remember how much it cost when you bought it?

P: This? 150.

E: Do you feel that was expensive?

P: No... well, a little (laughter).

E: It looks very good.

P: Yes.

3. INFORMATION

E: So, when this cooker came, did someone bring it, install it, and show you how it worked?

P: I, I knew how to use it, I tried it myself and, yes... I knew how to use it.

E: How did you know how to use it?

P: Because I learned to use it. The brought it from [the NGO].

E: And did they teach you how to use it? No, or, how did you learn?

P: Yes, they taught me how to use it.

I: They were taught how to use it; we came to install it.

E: Ok.

I: For example, here, in (inaudible) we, the technicians are the ones who came to install. Sometimes when there is more volume in the communities, lately [NGO2] has helped us a lot, [NGO2]], they send volunteers, so we make up groups and they come to install them.

E: Ok, thank you, ok. And, are those the pots you use then?

P: Yes, those, yes.

E: And what did you do before, you used other pots, right?

P: Yes, the pots are there.

E: And can you still use those or not?

P: Yes.

E: You still use the ones you had before?

P: Before, before.

E: You use them all?

P: Yes, all of them.

4. ADOPTION

E: Well you haven't been using this new cooker for long, but can you already notice what the advantages and disadvantages are? Right? Some things that you don't, don't like about this one compared to the previous one?

P: It's nice. It's nice to use, yes. (Speaking Mayan language) The first one wasn't good, too much smoke, but not anymore, yes.

E: So, it's mainly that there is less smoke.

P: Yes, less.

E: Anything else that you think has changed?

P: No, nothing else.

E: Mostly the smoke.

P: Yes.

E: The smoke, the chimney.

P: Yes.

E: Ok.

I: She says she had to make her open fire and only had this on top.

E: Mmm and she had three.

P: Yes, I had two. It's there behind the house it was made of mud, she used mud, like this.

E: But it's smaller than this one, right?

P: No, they're the same.

E: Can you still cook the same, the same amount?

P: Yes.

I: Less.

P: Yes, less.

E: So, you're happy with your new kitchen, there isn't anything... and have you noticed anything... well the smoke...

P: Not anymore. There isn't any anymore, now the smoke is able to escape so there is less.

5. HEALTH

E: Do you feel it? Do you feel better?

P: Yes, yes, I feel better.

E: And before, when you had an open fire...

P: Before there was too much smoke so I would get sick with a cough.

6. SAFETY

E: And, um, did you ever have any accidents with the open fire?

P: Yes, open, a lot of smoke.

E: But what about domestic languages? Burns, fire...

P: No, no.

E: How many times did you go out to cook? Now it's lunchtime, right?

P: Yes, I don't make my tortilla anymore, right now I don't... I'm cooking until now... three times.

E: Three times?

P: Breakfast, dinner, lunch.

E: Super. Thank you. So, you are very happy with your purchase, right? Satisfied.

P: Yes.

E: That's great. Well I think I'm done here. If... do you have any other question or comment you would like to make?

P: No, nothing.

E: No? Ok

INTERVIEW 7

1. PRESENTATION

E: I am P, this is E, I am 28, he's 26. We work for the Inter-American Development Bank, and we are here to ask some questions about your new cooker and how to improve it. So, if you have time, and if you are ok with it, we will ask you a couple of questions.

P: Yes, it's fine.

E: And we will be recording what you say

P: Ah, (laughter).

E: Otherwise...

E2: Or we lose it

E: ...we lose the information. And, probably the interview will be later published, but without your name, it will be anonymous.

P: Oh, ok.

E: It will not have your name, just so you know.

P: Aha.

E: Is that ok? Yes?

P: Yes, yes, it's ok.

E: Ok, great. So, E, how many people live in this house?

P: Three

E: It is you, your husband and daughter, right?

P: Aha, yes

E: And how long ago, well, here is where you cook, it is the only place where you cook, right here, right?

P: Aha, yes

E: Ok, great. Is this the only cooker you use?

P: Aha

E: Ok. And, it is new, right? It looks new. For how long have you had it?

P: For a month.

E: For a month?

P: Aha

E: Did you buy it?

P: Mmm, let's say we gave a contribution.

E: Ok. How much was it? Do you remember?

P: 150

E: Did you find it expensive? Do you find it expensive? Was it expensive?

P: No.

E: No?

P: No, it was a contribution.

E: For what it is, it did not seem expensive to you, ok.

P: Aha.

E: Who had the idea of buying the cooker?

P: Well, both my husband and I

E: Really?

P: Yes

E: And, why? Why did you decided to change? What did you use before? A fire...

P: Aha, yes

E: An open fire

P: Aha, yes

E: Where did you have the open fire?

P: Here.

E: Right here?

P: Aha, yes

E: But you still had the ceiling and walls? Or was it a little...

P: No, it was the same.

E: Ok

P: Aha

E: So, there was more smoke in the living room, right

P: Aha

E: If everything was closed

P: Yes, aha.

E: Ok, so it was a decision of both of you, and why? How did you decided to change the cooker?

P: Because this griddle heats up faster.

E: Is that the only reason?

P: Aha

E: Ok. Are taking part of the program, also, with [the NGO]?

P: Aha

E: Of workshops, yes? Are you in it?

P: Yes, aha.

E: Ok, super.

P: Yes.

E: And before having this cooker, of buying it, did you know anyone who had it, did you see it somewhere else

P: No

E: No.

2. INFORMATION

E: And, did someone come and install the cooker?

P: Yes

E: Someone came, installed it...

P: Aha

E: And, did it take them long to install it?

P: Mmm, no.

E: How lon... how long?

P: Around twenty minutes

E: Alright! All in twenty minutes?! Even the chimney?!

E2: Twenty?!

E: Aha, yes, it was all already here, they just came.

E2: (Laughter) They made a hole, I don't understand

P: Ah! We did that.

E2: Ah! Ok, ok
(Laughter)

E: Sure. And did they know, the person who came and installed it. Did he come before and see where he was going to put it? Or, not?

P: Aha, yes

E: There was a visit before?

P: Yes, that is why we made the hole.

E: Mhm! A pre-installation visit. Super! And, did anyone teach you how to use it? Did you know how to use it?

P: Mmm no. They just explained it to me, they explained me there.

E: Ah, they explained you there at the workshop program, right?

P: Aha, yes.

3. USE

E: And, so, you use a firewood, right? For, as fuel?

P: Yes

E: Y And the firewood, do you but it? Or, how? Where does the firewood comes from?

P: We buy it

E: Always?

P: Aha, yes

E: You never go out and get it?

P: Mm no, we always buy it.

E: Is the firewood expensive?

P: Mmm a little, I would say yes

E: Yes? Hoy much, approximately? How much is it?

P: Mmm 100. We buy it by three...

E: And, how much do you use on a month? Do you know, more or less, if it is three?

P: How much do we send? Mmm, I would say one load, one load I would say.

E: A load?

P: Aha

E: This one, now, takes less

P: Aha, yes

E: Because, I suppose, that now in the last month, right?

P: Aha, yes

E: And, with this cooker, what do you do? Do you...just cook? Do you heat anything else? Do you use it for things other than food?

P: We heat up water, to bathe.

E: Water. And, what do you cook, typically? What do you typically cook? Y

P: Well, we cook beans here and egg, just that.

E: Tortilla?

P: Aha

E: Tortilla

P: Aha

E: Where do you cook them, the tortilla?

P: Here

E: Ah! Right here you could do it too.

E2: In the same griddle?

P: Aha, for example the pot is here and here, it also heats up.

E: This part heats up too, or not?

P: Aha

E: Everything is hot?

P: Aha, just here not so much, until here.

E: Ah, here it is less

P: Aha

E: Ok. And, ok, good. So, ok, ok. Easy. And, the pots that you use now with this one, are they new?

P: No.

E: Those are the same pots you used before?

P: Aha, yes.

4. ADOPTION

E: Ok. And, now, well, you have been using your new cooker for a little while now. But, if were to compare it to the one before, which...how...do you feel any advantage or disadvantage with this cooker? Anything you don't liked with this new one? Or...

P: Mmm no I think everything is fine.

E: Yes?

P: For example, there is no smoke today.

E: Yes

P: Aha

E: And, anything else?

P: No.

E: What have you notice? Any changes, other than the smoke?

P: No, not at all

E: Not for the moment?

P: No, no.

E: And, before when you had the open fire, did any accident, burnt or fire occurred

P: No.

E: No? Ok.

E: So, for the moment, what is your opinion on the cooker? Would you recommend it to anyone?

P: Yes! (Laughter)

E: Yes? Ok, super! I think I'm ok here.

E2: Me too.

E: Ok. Thank you very much.

P: You're welcome.

INTERVIEW 8

1. PRESENTATION

E: You said A, perfect. How many people are in the house? How many people live here?

P: How many live here?

E: How many people live here....

P: There are 7

E: 7 persons... it is you, your husband and, you have 5 children?

P: Yes

E: Ok, super. And, this is your kitchen?

P: Yes

E: It is here, you cook everything here? Is this the only cooker you have?

P: Yes, just that one

E: But you're not cooking right now? You are not going to cook?

P: Not yet, I mean, until right now.

E: What are you doing right now?

P: I going to make my tortilla

E: And, how is it being made? Or, why no...it comes out? You are waiting for it to heat up...

P: Yes

E: And, after, how do you make it? Where do you put the tortilla?

P: There in the griddle (laughter)

E: But not over the fire? You close this part?

P: Yes, yes

E: And you put it over it. But it has to heat up first

P: Yes, yes

E: Does it take long to heat?

P: Mmm no, it just takes a while and then...

E: To heat up the griddle...Ok. So, for how long you have had this cooker

P: Mmm, maybe 17 years

E: You've had this cooker for 17 years?

P: Yes, yes

E: You've always had this one?

P: Yes

E2: Well built... (laughter)

E: Very resistant. So before, you've never used an open fire outside?

P: Aah, before yes but not now.

E: But, so, you've been using exactly this griddle for 17 years?

P: No, no. The griddle is from 2011

E: Ah ok, so, ok, 17 years for the space, but the griddle...

I: Is just that she understood by cooker you meant kitchen, not the griddle.

E2: Ah that you cook with...

E: Ah, of course, I'm sorry it is a... I meant, I'm sorry, the griddle, the chimney, the chimney is also from 2011?

P: Yes...

E: Ok super. And, so, this griddle with the chimney, did you buy them 9 years ago?

P: Yes

(Interruption – A's children come in)

E: Who had the idea of buying the cooker, the griddle and chimney?

P: It is in, an institution too.

E: Ah, yes?

P: Yes

E2: Do you remember? The name?

E: She says she doesn't remember the name; she doesn't remember.

E: And, was there a program before buying it? Did this institution not speak with you? Did they explain?

P: Yes

E: But it was your decision to buy it, or not? Did they just take you too...?

I: Ah, they just gave it. They went to this institution to be trained on how to make soap and coffee, she said, things about coffee. And they gave it to them. (A continues to speak in Mayan language) She is saying they didn't... well, it was with a contribution...she said they paid Q. 135 for the cooker, for the griddle.

E: 9 years ago?

I: 9 years ago

E: Ok, it was expensive back then, right?

I: Exactly, back then it was expensive.

E2: Sure, sure inflation

E: Ok, super. And so, these are all the pots, the equipment you use to cook.

P: Yes, yes

E: Is it the same equipment you used before?

P: Mmm, no

E: Before the griddle?

P: of mud (laughter)

E: Is it all new?

P: Yes

E: You had to buy it? Was it expensive?

P: Yes, it is expensive

E: A lot of money?

P: Yes (laughter)

E: And, what did you do with your old pots? What did you do? Where are they?

P: They don't exist anymore

I: They are not here anymore

E: You threw them away?

P: Yes

E2: Any problems? Since 2011, have you had any problems? I mean, something that needed to be fixed, something like that?

I: She says that the problem she's had is that the smoke is not going, because the duct is chipped, maybe because of the heat, and time, it chipped. So, the smoke won't go out, but would come this way instead of up there. And, also, all around the griddle there has been a lot of smoke coming out...

E: Y, how did you fix it?

I: Mmm, she says no, because they're thinking of fixing their kitchen...the house.

E: That's there's smoke. That is why there is a Little smoke here

I: No, you mean if they've fix this...

E2: The griddle

I: That's why she was saying no

E: Of course, that's why I'm saying that you can see there is a Little smoke...

I: Yes, of smoke, aha and no they haven't fixed it because they have the dream of fixing their house

E2: The whole house, right? I mean....

I: No, maybe just changing the roof, something like that, fix it. And when they fix it, they can take care of that.

(conversation not relevant to the interview)

2. INFORMATION

E: Before having this, did you know anyone who had this cooker? Have seen...

E2: Anyone else?

E: Before the institution...

I: Yes, they have seen with their neighbors, and yes, they've wanted something like that

E: And, did someone come and install it or teach you how it worked?

P: (Speaks in Mayan Language)

E: Excuse me?

I: They came and install it

E: Ok, did they teach you how to use too?

P: Yes

E: So, you had no difficulties on using it?

P: No

E2: If you were to change the cooker, when you fix the house, what would you want you're your new cooker?

I: She says she thinks of leaving the cooker there and the only thing she would change would be the duct

E2: So, it is...

3. USE

E: And, you use firewood, right?

P: Yes....

E: Or sticks and all that

P: Yes, we use

E: You go out to find it, right?

P: Yes

E: Do you also buy the firewood? O, not?

P: I buy.

E: Both

P: Yes, both

E: Depends on the money?

P: Yes, if not I go and get it myself

E: Ok, is it far away?

P: Yes

E: How far?

I: How long does it take to get there?

E: How long?

I: Ah, around 15 minutes

4. ADOPTION

E: Ok, thank you. Ok. What are... do you like this cooker? Do you like it? Are there things you don't like of the cooker? If you think of before, in the past, with the open fire and this one; what are the positive, negatives, advantages, disadvantages?

P: That I like the griddle

E: You like the griddle?

P: Yes

E: Why do you like the griddle?

I: She says she uses a little less firewood and that when she cooks, she can make tortillas, when can have another pot, and make several things at the same time.

E: Any disadvantage?

I: I think she mentioned it before, about the smoke, that the duct is chipped, that is why the smoke is coming inside and coming out the sides... -Anything else? (She asks Alberta)- Just that.

E: Ok, thank you. Because it is defective. Since you bought the cooker, back in 2011, did anyone come to see your cooker?

P: No.

E: From the institution?

P: No

E: Never?

P: No

E: What have you notice? Any changes, other than the smoke?

P: No, not at all

E: Not for the moment?

P: No, no.

E: And, before when you had the open fire, did any accident, burnt or fire occurred

P: No.

E: No? Ok.

E: And, one last thing, after you changed from the open fire to the cooker, have you noticed any changes in your health? Like physical? Or safety, accidents, burns. Have there been any changes?

I: She says she never had an accident, and she use to have headaches because of the smoke, now is less and when there is a lot of smoke coming out her eyes get watery.

E: Ok, I'm good with this. Thank you very much, Alberta. Enrique, are you good?

E2: Yes

INTERVIEW 9

1. PRESENTATION

E: Before we begin, Ms. R, how many people live in the house?

P: We are 4

E: You are 4, meaning 2 children of 7 and 3 years, you are 25 and your husband ...

P: 30

E: 30. What does the family do for a living?

P Well I am a housewife.

E: Ok, and your husband?

P: He is a keyer

E: Ok

P: But he is a teacher now

E: Ok, very well. You are in charge of cooking?

P: Yes

E. Ok. Perfect. To cook in your stove, Ms. R, you use woodfire. What type of woodfire do you use?

P. Pine

E. You use pine, just pine? Or maybe you use another type?

P. Oak

E. Pine and oak, very well. Ms., your stove, how long have you had it?

P. I don't remember when they gave it to me.

E. When was this?

P. It was in August, if I'm not wrong

E. Ah, August. It's been 6 months.

P. Yes, more or less.

E. Perfect. And, how many times a day do you use it?

P. 3 times

E. 3 times a day? So, you cook breakfast, lunch...

P. And dinner

E. And dinner

P. Yes

E. Ok, perfect. Other than this cooker, do you have another one?

P. Just my stove.

E. the gas stove?

P. Yes

E. You have a gas stove?

P. Yes

E. Ok, and how many times a day you use it?

P. Every once in a while, when I need something immediately.

E. So, you would say maybe weekly, could be...

P. Yes

E. You don't necessarily use it all the time

P. No

E: Ok. How many times a week do you have to use it?

P: Like 2, 3 times

E: Like 2, 3 times?

P: Yes

E: Very well. And, how long have you had the cooker?

P: 2 years

E: 2 years?

P: Yes

E: Very well. Ms. R, the firewood, do you but it or go out and get it?

P: I buy it

E: You buy it, how much is the firewood here?

P: 160 the load

E: 160 the load. And, the gas, how do you buy it? Per tank? Or how does it come?

P: Per cylinder

E: Per cylinder, and, how much is a cylinder?

P: 115

E: 115. And, how much woodfire do you spend a week, Ms. R? O a month? How do you buy it?

P: I buy it per load, and it lasts of 2 months.

E: Ok, 1 load every 2 months. Perfect. And, the gas, how long does it last? How often do you buy?

P: Every 4 months

E: You buy a cylinder every 4 months?

P: Yes

E: Very well. Today, for how long have you been cooking in your cooker, Ms. R?

P: Today?

E: Today

P: I have basically used it all day

E: All day? Since you got up? At what time did you start cooking?

P: Since 5:30

E: Since 5, so you've been cooking for 3... 7 hours.

P: Yes

E: Ok. And, for example, did you use it more yesterday?

P: I used it a little less yesterday

E: A little less? For how long did you use it yesterday?

P: It was breakfast, lunch and dinner. But today I've had it on all day.

E: Ah ok. For example, how long does it take you to make breakfast?

P: An hour and a half

E: An hour and a half? And, lunch?

P: Same, about an hour and a half

E: About an hour and a half?

P: Yes

E: And dinner

P: Like two hours

E: Ok. And, for example, when you cook beans or nixtamal, how long does it take you to cook beans?

P: Beans...that is exactly what I cooked today all morning

E: Ah, that is why you had it on for so long

P: Yes

E: Ok, perfect. Very well. To cook, do you use any special pot? Aluminum, mud, pewter? Or, all?

P: Pewter

E: You like using pewter?

P: Yes

E: Very well. Do you cover them when you cook them? Or, is it not necessary?

P: Yes

E: You cover them? Very well. Ms. Reyna, the ashes, is it necessary to clean it from your cooker? or, is it not necessary?

P: It is necessary

E: It is necessary?

P: Yes

E: And, how often do you have to do it?

P: Every week or more

E: Every week? Ok. And, for example, the chimney, is it necessary to clean it? Or, is it not necessary?

P: Yes, it is necessary.

E: And that, how often do you have to do it?

P: Every week

E: Every week to? You do both then

P: Yes

E: Other than cooking, do you use your cooker for something else? Like, heating water for bathing

P: No

E: Do you cook food for animals?

P: No

E: No? Ok, perfect. Y, what do you like about your cooker?

P: It is thrifty

E: It saves firewood. You like it saves firewood.

P: Yes

E: Ok. And, what do you not like?

P: (Nervous laughter) Everything is fine.

E: Anything? Feel free to respond, that information always helps so we can improve. So, I don't know, maybe you'd like it to be bigger, to have another burner, for more firewood to fit it, less firewood, maybe it being another color.

P: I don't know. Ay! I like it as it is.

E: You like it as it is? Ok, perfect. Ms. R that would be all from our part. P will now ask you further questions, and well, thank you for your time.

P: Thank you.

2. INFORMATION

E: Hello, how are you?

P: Fine, thank you.

E: So, your name is Reyna?

P: Yes

E: I am P, a pleasure. This is E. We all work together. But we are going to ask you some questions. We work for the Inter-American Development Bank, it is Washington. And, so, V and J are putting this to ventilate the air where you are. We are interested in having your perception on the use of the cooker so as to improve it. Now you said it is fine, that you like it, but maybe there are other things that we can improve for the future, so while I ask you a couple of question, we will be taking note, we are already recording, I hope you don't mind, it is all anonymous, your name won't appear at all. Ok?

P: So, it won't be on Face?
(Laughter)

E: It won't be on face! No! Do not worry about it. And, so, we understood that there ae 4 people here in your home, the child, you've had the cooker for 6 months. We want to ask you, before having this cooker, you bought this cooker? Right? You? And, how did you learn about the cooker?

P: What do you mean?

E: How did you find out? When did you hear about the cooker? How did you know about this cooker?

P: The lady told me about it

E: Ah, right, with the program of the [NGO], right?

P: Yes

E: Ok, perfect. Ah, are you in the workshop program?

P: Yes

E: Ok. Super! And, so, and before this program started, did you know anyone who had this stove before?

P: No

E: No?

P: No

E: No, you've never heard of this like...? Ok, and, someone came to install the cooker?

P: Yes

E: Yes? Someone installed it for you, with the chimney and all?

P: Aha

E: And did they explain you how to use it? Or, not?

P: Yes

E: Ok. Someone came, explained...to install, explain, super. And so, well and about this one you said you use firewood, you buy...

P: Yes...

3. USE

Where does your fuel come from? What equipment do you use with this one? Can you show us? Could you tell us what its daily use is?

E: The equipment you use the, are, all those pots?

P: Mhm

E: And, what did you have before? You had...what did you use before this cooker?

P: The same, one, that use more firewood

E: Was it open?

E2: Ah, open in the ground?

P: No...

E2: You mean, open but with a plate

P: Yes

E2: And, when you made the decision of buying it, I mean, when you decided it to buy it, did you discuss it, did you discuss this with your husband? Or was it...

P: Yes, I told him about it and the lady who gave me this opportunity.

E2: Sure, sure. And, do you know anyone who had a similar one?

P: No

E2: And, because I know this is one of the newly installed, after, I mean, did someone you know saw the cooker and maybe said like well this seems like...I mean, did they like it and got one too?

P: Yes

E2: If you could have something else in the cooker, I mean, we know it's really good, but more, I mean, if you'd want more, what would it be? Some hooks? Something to hang the cutlery?

P: That would be ok, yes, maybe. Because I have were to store the firewood under here...

E2: And the pots behind, right?

P: Yes

E2: So, something to hang

P: Mhm

E: And, do you use the same pots as before? Before when you had, that's where I wanted to get before, when you used the open fire here inside the house and were those the same pots or did you change them?

P: Yes, they are the same.

4. ADOPTION

E: The same ones? Perfect. And, since using this new cooker, have you notice any changes some way, that you can tell us about?

E2: Other than the firewood

P: Yes, it saves a lot of firewood, there isn't that much smoke in the kitchen

5. HEALTH

E: And physically, how do you feel? Your health?

P: Yes, yes, one... Yes, and my children and I, because before I felt that when there was a lot of smoke, I would expel a lot of phlegm, a lot of phlegm, sometimes it was even black, like it was smoke. And now all that is improving.

6. SAFETY

E: Ok, perfecto! And in terms of accidents in the house, before when you had the open fire, did you have any accidents, fires or similar? Or, no?

P: Thank God, no.

E: And neither with this one, we're ok, right?

P: Yes

E: And, now, you are happy with this. Is there anything that you would like to improve, that you are thinking, well as E already ask, but, does anything else comes to mind?

P: It is fine

E: Perfecto! Any comments? Anything you would like to say or ask? Or...

P: No, it's all good.

E: Thank you very much for your time, sorry to have bother you.

P: Don't worry about it. Thank you.

INTERVIEW 10

1. PRESENTATION

E: How many people live in your house, Ms. D?

P: We're 6

E: 6 people

P: Mhm

E: From those 6, how many are children?
(inaudible)

E: And, how old are them?

P: There is one of 14...(inaudible)

E: The 14-year-old is a boy?

P: Yes, he's a boy

E: Ok, and adults, there are 3?

P: Two

E: Two?

P: Me and my husband

E: How old is your husband?

P: 33

E: 33

P: Yes

E: Ok, so, from the children I have on of 1 year, an 11-year-old and the 14-year-old, I'm missing one.

P: Oh, the 9-year-old

E: 9, ok. Perfect. What does the family do for a living, Ms. D?

P: (inaudible)

E: And your husband?

P: Mis husband is a farmer

E: He's a farmer?

P: Mhm

E: Farmer, what does he grow?

P: Sometimes tomatoes...we have coffee too.

E: Are you the one in charge of cooking?

P: Yes

E: Very well, in your stove, what type of firewood do you use, Ms. D?

P: The firewood I find

E: What would that be? Pine, oak?

P: Whichever

E: Whichever type of firewood you find=

P: Yes, whichever type of firewood we find, we use.

E: Ok, do you usually find more than one type?

P: Oak

E: Oak is what you find the most?

P: Yes

E: Ok. Very well. How old is your stove, Ms. D?

P: About 5 years old

E: About 5 years old?

P: Mhm

E: And, how many times a day do you use it?

P: 3 times

E: 3 times a day, you cook breakfast, lunch and dinner there?

P: Yes

E: Ok, besides this stove, do you have another one?

P: No, just that one

E: Just that one? Ok, how do you get the firewood, Ms. D? Do you buy or get it yourself?

P: We get it ourselves

E: You get it yourselves

P: Yes

E: Perfect. And when you go and get it, how do you travel? Do you walk, by car or do you own an animal?

P: We walk

E: You walk

P: Yes

E: Ok. How long does it take you to get there? To get from here to where you get the firewood.

P: About half an hour

E: About half an hour?

P: Yes

E: Do you know how far it is?

P: All the way there... on the other side of the river.

E: In kilometers, would you know a number?

P: I don't know

E: You don't know, Ok. And, for example this firewood that you get, how long does it last? How much time do you spend on your stove for...

P: Maybe a load, a month, more or less.

E: Ok, a load a month?

P: Yes

E: Very well. Today, how long have you cooked in your stove? But, for example, today you woke up, at what time? And...

P: At 6... like 2 hours.

E: You cooked at 6? You started at 6 and finished at 8 in the morning?

P: Mhm

E: And then, you did not turn it on?

P: No, until 11

E: Oh ok. And now it is...off?

P: Yes

E: Now you have it, off?

P: Yes

E: So, you cooked, how many hours at lunch? 2?

P: 2

E: Ok

P: Mhm

E: 2 at lunch and 2 at breakfast.

P: Yes

E: And, for example, did you cook more yesterday than today?

P: Mmm, no. Almost the same

E: You also cooked 4 hours? You did not cook dinner yesterday?

P: Yes, I did.

E: For example, how long does it take you to cook dinner?

P: About half an hour to cook dinner

E: Half an hour? Ok.

P: Is not the same as in the morning

E: And, for example, when you cook beans or nixtamal, you cook beans and nixtamal?

P: Yes

E: Does it take you a little longer?

P: Yes, that takes time. With the nixtamal about an hour and a half.

E: About an hour and a half. And, beans?

P: Beans take longer

E: How long...

P: Almost half the day

E: Almost half the day? Ok. Perfect. Do you use any special pots when cooking? Clay, aluminum, pewter? Any of those?

P: Clay, when I cook beans

E: Clay?

P: Yes

E: Ok, and metal, do you use metal pots?

P: Yes, I do

E: Ok. When you cook with your pots, do you cover them? Or, is not necessary?

P: Yes, I cover them

E: You cover them? Ok. The ashes that come out of your stove, do you take it out? Or, is it not necessary?

P: No, I always take it out

E: Yes? How often do you have to do it?

P: 3 days

E: Every 2 days?

P: Yes

E: Very well. And for example, I see your stove has a chimney, do you must clean it? Or, no?

P: Yes, it is necessary. I always do it.

E: Ok.

P: I push it so all the ash that is inside comes down.

E: How often do you have to do that?

P: Every month

E: Every month?

P: Yes

E: Perfect. Do you fix some of the cracks in your stove? Or, is it not necessary? For example, I see you have a few.

P: Mhm

E: Do you leave them like that?

P: No, I always put lime on them

E: You put lime? How often do you have to do it?

P: Oh! Always, when I cook in the morning, at noon, always, if I'm going to make tortillas, I always put it. I put it every time.

E: You fix the cracks every time you use it? Ok. For example, you heat water for bathing.

P: No

E: No?

P: No

E: You do cook nixtamal there, right?

P: Yes, that I do

E: Do you cook animal food there?

P: No, I don't have animals

E: Perfect. We're almost done, Ms. D. Do you like your stove?

P: I like it a lot

E: What do you like? That it cooks fast?

P: Mhm, oh yes.

E: The appearance, the size, that you can fit many pots

P: Yes, I like it because I put three pots

E: Ah, you like it that you can put many pots?

P: Yes, so you cook faster.

E: And you cook faster?

P: Mhm

E: and, what do you not like?

P: (inaudible)

E: For example, what do you not like of your stove? What would you improve? When you use it, anything you don't like that you think "if it had this", "if it were like this"

P: No, I like it

E: You like everything about your stove?

P: Yes

E: Ok. Well, that's all from our part Ms. D, E and P will make some further questions and then we're done.

E: Hello, D, right?

P: Yes

E: I am P, a pleasure. Hello, how are you? So, we are also here with E to (interruption) we're also here to ask you things (interruption) so we will ask you some questions, on top of the ones V asked, about the uses of the cooker, to see how we can improve them. We will be taking notes, we are also recording, but this is anonymous. Your name won't appear at all, don't worry.

P: Yes

E: Ok. So, you have 4 children.

P: Yes

E: One of them is 14, you've had the cooker for 5 years, did I get that right?

P: Yes

E: And, the stove, did you buy it? Did you buy it?

P: Yes

E: Was it expensive?

P: About Q. 300.00

E: And, how did you make the decision? What did you use before? Did you use and open fire?

P: Yes, that is what we did.

E: Where was the open fire?

P: Here

E: Right here?

P: Aha

E: And, was it all covered?

P: Yes, but it was very difficult, that is why we decided to buy

E: It was difficult, in what way?

P: You burn with the fire, but with this you don't get burn...

E: Did someone get burn?

P: Yes, that is why we decided to buy...

E: it seemed dangerous

P: Yes

E: That it why you decided like...

P: For the children...

E: Yes of course, and then, so you made the decision. But was it, from you or your husband?

P: Yes, my husband

E: His, yours? Both of you?

P: Both

E: Before taking the new cooker, did you see it somewhere else?

P: Yes, at my mother's, she has one of those, so we decided to buy...

E: Oh! She has the same?

P: Yes

2. INFORMATION

E: Ok. And, that's when you hear about the program? And you bought it. Y when you bought it, did someone come to install it? To help you install it?

P: No, my husband did it

E: The husband installed it?

P: Yes

E: So, and, did anyone teach you how to use it?

P: No, I just went to my mom's and how she did it, like that.

E: Ok, but no one came to teach you

P: No

E: You learned yourself with your mom. Thank you very much So, you use the firewood you buy?

3. USE

E2: That they collect

E: Oh. Sorry. Collect, right? The firewood

P: Yes

E: All the firewood that is there, you go and get it?

P: Yes

E: Without paying anything?

P: No.

E: Oh, good

P: Mhm

E: Ok, super. And, do you generally go together to collect it?

P: My husband and I, and sometimes the children come.

E: Ok. Perfect. And, before, the pots you used with the open fire, are they the same you use no?

P: Yes

E: Are they the same? Has this not changed?

P: No, they are the same.

4. ADOPTION

E: Ok, super, perfect. And, there I was thinking that, you could tell us which are, now that you have this cooker, with respect with burns, it has been better, the accidents. And, anything else?

have you notice any other advantage? Or, maybe, another disadvantage? Something you don't like about this cooker?

P: No, I like it. The disadvantage is that it does not use a lot of firewood.

E: That is the good thing?

P: Yes

E: The good thing is that you use less firewood

P: Yes, I use less firewood. Because before it was open, so it used more firewood.

E: Yes, but the firewood is free. But the thing is you have to go out and get it.

P: It is hard to get it.

E: Is it far?

P: Yes, it is far

E: And, anything else? Other advantage since you use this one? Have you notice how you feel, physically, your children? Your health? Things like that. Have you notice any difference?

P: Yes, there has been a difference

E: Like what? For example?

P: Like the children`s health, as I was telling you, like this you don't burn yourself, because if it is open you get burned.

E: It is more because of the burns?

P: Yes

E: Is there anything else you'd like to say or ask, maybe?

P: No, no

(D says that Spanish is hard for her, she is then offered the interpreter and she agrees)

I: Just what she was saying about the firewood, that yes, before it would use more firewood since it was an open fire, she would put firewood like this and that, everywhere, but now it is only going in one side. And that with the open fire, when making the tortilla, because the fire is like this, and you make the tortilla and put them, none of her children has burned, neither has her, but she says that when she was making the tortillas, she didn't but she could feel a very high temperature when making the tortilla, since you put it and you turn it around ...

E: You mean here?

I: No, with the previous. So here you don't see those things, nor the smoke. Where maybe she is having a little trouble is with the chimney, but it isn't too much.

E: But she cooked here today, she has been cooking today?

P: Yes, mhm

E: Anything else?

I: I asked her, but she said no...

E: The rest is fine?

I: Mhm

E: Did she say everything?

P: Yes

E: Super. E, we are good.

E: Thank you very much.

E2: Thank you very much.

P: Ok, thank you too.

INTERVIEW 11

1. PRESENTATION

E: How many people live in your house?

P: 11...12.

E: 12? And, do you cook here for 12?

P: Yes.

E: Are you responsible for cooking?

P2: No, my mom.

I: But right now, she is responsible because ...

E: So, both of you cook and...and (inaudible)...So, 11 people live here. Of those 11 people, how many are children?

P: 7 kids.

E: 7 kids. Do you know their ages?

P: I don't know that. The second child is 17 years old.

E: 17. Is he a man?

P: Yes, man.

E: Ok. And the little ones ...?

P: Another.

E: Maybe you start with the little ones first.

P: This one is 2 years and 6 months old.

E: Mhm, and then?

P: And then he is 4 years old.

E: 4 years old. Then?

P: And 10 months.

E: Mhm. If you want, only the years.

P: Only the years?

E: Yes, so that it's not so difficult.

P: The other one is 10 years old.

E: 10. Then?

P: Then, is 8 years old.

E: 8.

P: The other one is 7 years old.

E: 7.

P: The other one is 14 years old.

E: 14. Is he a man?

P: Yes, all the men.

E: Ok. Fine.

P2: They are all men; I am the only girl.

P: Only the only one who is a woman.

E: Ok... How old are you, madam?

P: 39 years old.

E: 39.

P: Mhm.

E: And Sonia?

P: She's 18.

E: 18.

P: Mhm.

E: I'm missing 2 people.

P: And her dad. He is her dad. He is 44.

E: 44. And 1 more?

I: The girl over there?

P: The girl is 2 years old.

E: 2.

I: And, the little one who has just been born?

P: Is 2 weeks old.

E: Ah that's the one that was missing! I'm going to put less than 1. There we go. Ok...what does the family do?

I: Your dad is a farmer, right?

P: Mhm.

E: Farming?

P: Yes.

E: What do you grow?

I: Is it yours what your dad works or...

P: Working firewood.

I: Working firewood.

P2: They working firewood.

P: Working firewood.

I: So what? Where does he work? What crop are they working on?

P2: They are splitting firewood.

I: Just splitting firewood.

P2: Just splitting firewood.

P: Just splitting firewood and cutting the branches. Only two classes.

P2: Cutting and hauling, that's how it is.

P: That's how it is.

I: Oh yes! ...yes...yes.

E: Ok, perfect. Then you will be responsible for cooking.

P: Yes, today it is her turn.

P2: Today it is my turn.

E: It's your turn, perfect. In your wood stove, what type of firewood do you use? Pine, oak, rubber?

P: Scrambled.

P2: Scrambled.

E: Whatever?

P: Whatever.

P2: Yes, what it is.

P: What falls.

P2: What it is.

E: What's more? What do you usually find the most? Pine? Oak?

P: Pine and oak.

E: Pine and oak.

P: Mhm.

P2: Yes.

E: How much time do you have with your stove? how old is it?

P: It's 8 years.

E: 8 years.

P: Mhm.

P2: I don't know.

E: Here is someone who is helping us.

P2: (Inaudible)

E: Apart from this stove, do you have another?

P: No, just this one.

E: Just this one.

P: Just this one.

E: Do you cook everything here?

P: Yes.

E: Breakfast, lunch.

P: Breakfast, lunch and dinner.

E: Ok. Perfect. The firewood that you use, do you collect it or buy it?

P: Mmm more that I buy it.

E: You but it.

P: Mhm.

E: How much does the firewood cost here?

P: The splitted 160.

E: 160 quetzals the what?

P2: It's for load.

E: The load.

P: The load.

E: 160 the load.

P: Mhm.

E: And how much firewood do you consume? Per month or per week?

P: Mmm I do not know that, there we buy 3-4 loads.

I: How often?

P: Every 4 months ... 4-5 months

I: ¿ Every 4 months?

P: Mhm.

E: You mean; you buy 1 load per month?

I: More or less.

P: More or less.

P2: Yes.

I: Yes, one load per month.

P: Yes.

P2: Yes.

E: Perfect. Today, how long have you cooked on your stove?

P2: 2 meals.

E: You've cooked 2 meals?

P2: Yes.

E: And, how long did you take for breakfast? How long did it take you to make breakfast?

P2: 2 hours.

E: 2 hours. And lunch?

P2: Same.

E: Also 2 hours.

P2: (Inaudible)...it's still...

E: Ok. You're doing it there.

P2: (Inaudible)...until dinner ends...

E: And, for example, did you cook more or less than 4 hours yesterday?

P2: More.

E: More? How much would you say you cooked?

P2: Like 5 hours.

E: Like 5 hours?

P2: Yes.

I: But, right now it's because of the beans, isn't it?

P2: Yes.

P: That's why beans, when beans aren't there...

P2: When...(inaudible).

I: Yes, well.

E: Ok. How long does it take to you to make beans?

P: About 3-4 hours.

I: More!

P: More? It depends on beans, there is fast beans, there are beans ...

E: Ok.

I: Why? At what time do you put it?

P: That at 12 we put it.

I: And you remove it?

P: We will remove it now.

I: ¿12?

P: Yes.

I: Well.

E: Ok. It can be. And dinner? How long does it take you to make dinner?

P2: 2 hours.

E: It took you also to 2 hours to make dinner. Ok, perfect. For cooking, do you use any type of pot in particular? Clay, aluminum, pewter, all? What kind of pot do you use?

P: Aluminum.

E: You like aluminum?

P: Yes.

E: I see you have that one over there is clay, right?

P2: Mhm.

E: Do you also use clay?

P: Yes.

E: Do you usually cover your pots or is it not necessary to cover?

P2: Yes, covered.

E: Yes, you cover.

P2: Yes.

E: For example, right now you don't cover because it's...

P: We are going to take it out.

E: Ok. The ash of your stove, is it necessary to remove it or is it not necessary?

P2: Yes, it is necessary.

E: How often do you have to do that?

P2: Every day.

E: Daily?

P2: Yes.

P: Yes, daily.

E: And, for example, do you need to clean the chimney or is it not necessary?

P2: Yes, it is necessary.

P: Every 2 days.

E: You need to clean it there every 2 days?

P: Mhm, yes. (Inaudible).

E: Ok.

P2: (Inaudible).

E: Perfect. Do you have to repair some cracks in your stove or is it not necessary? Not that. Perfect. Besides cooking, do you heat water for bathing?

P: Speaks in Mayan language.

E: Do you have temazcal?

P: I do have temazcal.

E: Ok. The nixtamal, do you do it here?

P: Yes.

E: Ok. That firewood that you consume for the temazcal, is it within the load you told me about?

P: Yes.

E: Ok. So, to finish, what do you like about your stove when you use it?

P2: I can put many pots.

E: That you can put many pots? That's big, that you don't have to watch the fire?

P2: Speaks in Mayan language.

E: That is big and you can cook many things.

P2: Yes.

E: And what don't you like? What do you not like about your stove?

I: Something you don't like? Or what you would like to change? Or something it had?

E: For example, that it consumes less firewood, cooks faster, that...that it doesn't have smoke? That's in a different color? One thing you would like it to improve? Or what do you dislike when you use it? Yes, the first thing that comes to mind. What don't you like?

P, P2 and I speak in Mayan language.

I: She says it's fine.

E: Perfect.

I: That a lot of smoke comes out because the wood is ...when it's a little green.

E: Fine. Oh well, that's all from me. So, now P and E will ask you some very short questions and that's it. So, thanks for your time and well, I am here...

E2: First, I have a question. Why is it coming out now a lot ... a lot of smoke, isn't it? You said it's because something green...?

I: The firewood.

P: The firewood...yes.

E2: But does the chimney work?

P: Yes.

E2: Ok. Why doesn't the ... smoke go outside? I was looking to see, but I didn't see ...

I: No, right now it's not coming out.

E: Does the cooker work well?

P: Yes, S is cleaning well...(inaudible).

A. Your cooker: did you buy it? Whose idea was it to buy it? Why did you buy it? Was it expensive? Do you know anyone else who uses it as well? Since when do you have it?

E2: You said your cooker is 8 years, right? And did you buy the cooker?

P and I speak in Mayan language.

I: She says that an institution called [NGO3] ... it's famous... came here to the community and gave them this griddle and that since they...

E2: Was it made of iron?

I: Mhm... that they came to build this. Then they build it and they gave it all. The only thing they gave them was the food of the day they came

P and I speak in Mayan language.

I: 8 years ago.

E2: Ok. And since they came 8 years ago to install it, have they ever come back? Did you ever come back to see? [NGO3], never?

P: No.

P and I speak in Mayan language.

E2: And didn't it change? It didn't change in 8 years, right?

P: No.

E2: The chimney didn't change, it's the same, isn't it?

P: Yes.

E2: Ok. And, before using this one, did they have an open fire?

P and I speak in Mayan language.

P: Yes.

E2: Yes? Where? Where is...?

P: Up there...it was up there, rent house up there, until later I moved...as they gave me my land... until now our house is made.

E2: Mhm, ok. Was it outside? It was outside, right?

P: Yes.

2. INFORMATION

E2: Super. So, before they took the cooker to install, have you never heard, seen this cooker, or did you?

P and I speak in Mayan language.

I: She says she hadn't seen it anywhere.

3. USE

E2: Thank you. Ok. And the firewood...they buy it, right?

P: Yes.

E2: Always? Or occasionally they collect it?

P2: Always.

E2: They buy it, always. Ok. And the pots they use are the same as before, yes? Are they the same as before in the other cooker?

P2: Yes.

4. ADOPTION

E2: Ok. Since you changed the cooker, but you are very young because you were 10 years old, you may not remember, you will see if you remember, but you feel that there was, is there a change? To have this? If you compare to what you had before.

P2: Ah this is change! It changed.

E2: What changed?

P2: But before (inaudible) it burned us with the skillet, sometimes it burns our hand, but this

one does not, here you stay and cook, it does nothing.

E2: Ok. But the smoke, doesn't it bother you?

P2: Sometimes. But I fix it.

E2: But is that less smoke than before with the open fire? Is it more-less?

P2: It's more.

E2: Is that more smoke?

P2: No, less.

E2: Less. Ok. There's still. Ok. I have one ... another question for you. You've had that for 8 years, right? 8? From the beginning there was always this smoke too?

P: No.

E2: No. Over time?

P: Over time.

E2: At first there was not so much?

P: Yes...no.

E2: Ok. If you had the opportunity to change ... would you like a new cooker?

P and I speak in Mayan language.

E2: What would you change?

P, P2 and I speak in Mayan language.

I: She says they would not change anything because they just changed the tube about 2 months ago.

P, P2 and I speak in Mayan language.

I: It needs cleaning that's why the smoke doesn't come out.

E2: Ok. I think that with this we are fine. Thank you. Do you have... do you want to ask us something? Do you want to tell us something else or ask something?

INTERVIEW 12

1. PRESENTATION

E: What is your name?

P: E.

E: E?

P: Mhm.

E: And what's your last name?

P: [States an age between 25 and 35].

E: [Age] years old. And your girl's name?

P: K.

E: K?

P: Mhm.

E: And how old are she?

P: [States an age between 0 and 5].

E: [Age] years old, ok.

(Friendly conversation)

E2: So, to finish Mrs. Elva...

P: Mhm.

E2: I'm going to ask you some questions about your cooker ... and your house. How many people live in your house?

P: 4.

E2: 4. How old are they?

P: My husband is [States an age between 25 and 35] too.

E2: Ok, same as you.

P: Yes.

E2: And your little ones? 3...

P: The first is [States an age between 5 and 10] years old.

E2: Ahh and I heard that one was [States an age between 0 and 5].

P: Yes [States an age between 0 and 5] she.

E2: Perfect. And what does the family do, Mrs. Elva?

P: My husband is engaged in...agriculture.

E2: Agriculture, and what do you grow?

P: The blackberry, coffee, corn and beans.

E2: Blackberry, coffee, corn and beans.

P: Mhm.

E2: Perfect. Are you in charge of cooking?

P: Yes, I am.

E2: Perfect. On your cooker... what kind of firewood do you use?

P: Firewood...(inaudible).

E2: Pine, oak, alder, rubber.

P: Oak

E2: Oak is what you use.

P: Yes.

E2: Perfect. How much time do you have with your cooker, Mrs.?

P: I think more than 1 year.

E2: Ok, 1 year.

P: Mhm.

E2: How many times do you use it a day?

P: 3 o 4 veces.

E2: 3 or 4 times. Very good. Your firewood, how do you get it? you purchase it? you collect it?

P: Sometimes we buy it and sometimes we collect it.

E2: Ok. What do you do more? Do you buy more or collect more?

P: More we buy.

E2: You buy more. And how much do you consume of firewood?

P: Daily.

E2: Or weekly or daily? How?

P: Per month we consume like 4 loads or 3.

E2: Ok, 3 to 4 loads. And how much does each load cost?

P: It costs about 70, I haven't asked my husband very well.

E2: He is the one...the one in charge?

P: Yes, he buys it. Mhm.

E2: Very good. And for example, today how long have you used your cooker?

P: I believe that more than 1 year exact.

E2: But, for example, today at what time did you start cooking?

P: Today I started cooking at 11:30.

E2: And until now you have it.

P: No, right now no longer.

E2: Have you put it out?

P: Yes, at 1:30 I put it out.

E2: Ok, perfect. About 2 and a half hours today. The firewood you collect ... are you walking? Or do you have any animal? Or any car in which you go to collect when you have to go to collect?

P: My husband does it.

E2: He goes how? Walking?

P: Yes, walking.

E2: Walking.

P: Mhm.

E2: And how long does he take from here to where your husband goes to collect?

P: Half an hour.

E2: Half an hour to get there. Ok. Do you know more or less how far it is?

P: Ah! I don't know.

E2: You don't know. Ok. And how much firewood do you collect? Or how much firewood does your husband collect when he comes?

P: Hmm... Maybe half a load, I say.

E2: Ok, half a load.

P: Mhm.

E2: He collects half a load per month.

P: Mhm.

E2: Ok. For example, how long does it take you to make breakfast, Mrs. E?

P: I get up at 5:30 or 5:45 and enter here in my kitchen 7:30-8:00.

E: Ok, about 3 and a half hours for breakfast.

P: Mhm

E2: And lunch?

P: It's 2 hours.

E2: About 2 hours, ok. And the dinner?

P: Maybe about 2 hours too or less.

E2: Ok. And when you cook beans, how long does it take?

P: I put that to cook my beans from 6 in the morning to 12 at noon.

E2: You take 6 hours to make the bean. Ok. But in the meantime, you still keep doing other things?

P: Yes, mhm, yes.

E2: Perfect. What kind of pots do you use to cook, Mrs.?

P: I use clay pot, pewter.

E2: Ok. Clay, pewter. Do you cover them? or is it not necessary to cover?

P: Yes, I cover them.

E2: You do cover them. Very well.

P: So that they boil quickly.

E: Quickly. The ash from your stove, is it necessary to remove it or is it not necessary to remove it?

P: Yes, it is necessary because it accumulates there.

E2: And how often do you have to do that?

P: I take it out when it's...it's already accumulated...until then I take it out.

E2: And that is like every week?

P: No, every 3 days.

E2: Every 3 days, ok. And, for example, the chimney should it be cleaned or should it not be cleaned?

P: Yes, it has to be cleaned, because the smoke fills there. And the smoke does not come out when it is full.

E2: And that how often does it take you to do it?

P: I take that out every 15.

E2: Every 15 days. Ok. In addition to cooking, do you heat water to bathe on the cooker?

P: Yes.

E2: Sí, ok. Do you cook food for animals?

P: No, not for animals.

E2: Ok and here you cook your nixtamal?

P: Yes.

E2: You cook it right there. Ok. What do you like about that cooker?

P: Of save firewood.

E2: Do you like that saves wood?

P: Yes.

E2: Ok. And what don't you like?

P: I like everything of my stove.

E2: Something you would like to improve? For example, that the supports were bigger, that the griddle was bigger, that it had another burner, that it was taller. What would you like?

P: No, it's fine for me, it's fine like that.

E2: Just as it is you like it, have you adapted?

P: Yes, I already...Mhm, yes.

E2: When cooking don't you say, "why doesn't this stove have...something?"

I: How has this worked E, does the heat reaches over there?

P: Mmmm, yes it has worked.

I: Well this one takes a little more time.

E2: Mhm, yes. You say it takes a little more time. Is this also 3G?

I: Yes.

E2: Good.

I: But this one does takes...this one doesn't have the same time as the 3G that we saw, this one has more than 1 year almost 2 years, I think.

E2: It has 2 years now. Ok, perfect.

I: Almost.

E2: Ok, perfect. Well, that's all from me, Mrs. E. So, P and E are going to ask you some additional questions to finish. Thanks for your time.

P: Ok, don't worry. Thanks to you.

E3: Can I continue in the photo, if it doesn't bother you.

P: Yes.

E3: Your name is Elva, right?

P: Yes.

E3: Nice to meet you, I'm Pauline, nice to meet you. Thank you very much for receiving us at your home. With E, we work together at the Interamerican Development Bank and we work with V and J. And we are more interested in asking you things about the cooker and how it could be improved, advantages and disadvantages and about its use. So, these are some questions in addition to the ones you already answered, if it's ok with you.

P: It's fine.

E3: Thanks. So, you have 3 children and since when do you have your cooker?

P: How so?

E3: How long that you have this one?

P: Ahh more than 1 year.

E3: More than 1 year.

P: Yes, more than 1 year.

E3: And did you buy it?

P: No, it's a donation.

E3: A donation, do you know from who is the donation?

P: I don't remember.

E3: You don't know.

I: From [NGO]. This one if from [NGO].

E3: But is it a gift?

I: No, they paid. How much did they pay?

P: 150.

E3: Ahh, ok. So, it was not free, they had to pay something.

P: Yes, only 150.

E3: Ok. And whose idea was it to change? What did you use ... what did you use before?

P: I before only used a skillet, I didn't have a griddle.

E3: Where? Here?

P: Yes.

E3: In this same room?

P: Oh yes.

E3: With roof? Was there or was there not a roof?

P: Yes, there was roof.

E3: Does a lot of smoke pass through?

P: Yes, there was a lot of smoke.

E3: It was all closed with an open fire.

P: Mhm, yes.

E3: Ok. And how did the idea of changing the cooker come to you?

P: Well, thanks to [NGO] that they donated us that.

E3: But, before they gave you ... let's say this, have you never heard of this cooker before?

P: No, no, I hadn't, but we couldn't buy because they were expensive.

E3: Ahh but then you knew about this...

P: Yes, mhm.

E3: How did you know...that that existed?

P: I have seen with my neighbors, because they used these griddles.

E3: Did the neighbors have it?

P: Mhm, yes

E3: And did they say good things about the cooker?

P: Yes, mhm.

E3: Ok. And so, there are many ... many people, your neighbors who use this type of cooker also now, right?

P: No, not many also only some.

2. INFORMATION

E3: Ok. Thanks. And so, how did you install the cooker? How was it installed? Did someone come, did you do it? How was its installation?

P: My husband installed it.

E3: Someone took the things? Did your husband install it here?

P: Yes, mhm.

E3: And did someone teach you how to use it, how it was used or ...?

P: There in [NGO] we were taught how... how to use it.

E3: What training program?

P: Mhm

E3: Mhm, that's good. Are you still going?

P: No longer right now.

I: No, their project has already been closed. That was last year.

3. USE

E3: Ok. The pots...are all here that you use for cooking? Are all these?

P: Yes, these are the only ones.

E3: Are they the same ones you used before or did you change?

P: No, that is the same as before.

E3: Ok. And, your firewood then you said you bought it, right? Your husband bought it, occasionally you collected.

P: Yes, occasionally.

4. ADOPTION

E3: Ok. So now that for less than 1 year you've been using this new cooker. Could you tell us what are the advantages or disadvantages of this new...

P: The advantages of this one that it was used too much firewood and the smoke.

E3: Yes? And what would be the disadvantages? Is there anything you like less compared to the previous one?

P: No, I like everything about my griddle.

E3: Yes? Do not miss anything that was from the previous one?

P: No, no.

E3: Would you recommend then this cooker to a friend, family member?

P: Yes, mhm, yes.

5. HEALTH

E3: And have you noticed any change in your...for example, health or domestic accidents or a fire or a burn since you changed to this new cooker?

P: Yes, because before well, I didn't want to cook like this with my daughters because they sometimes play or do something and can pull a pot and can burn themselves.

E3: Mhm, something else, if not? Regarding your...how do you feel physically, your health, right?

P: As I say before the smoke was too much and it affected me with my eyes, but not now.

E3: Ok. And what exactly did you have with the eyes?

P: When I cook well, the smoke starts to come out and my eyes start to burn.

E3: It got how?

P: Burn.

E3: Then they hurt, it made you burn.

P: Mhm, yes

E4: Have you noticed in the time that you have, well you have 1 year already, have you noticed like any improvement? Have you noticed like some improvements in the griddle? If the heat is distributed the same, that is, the things you want to heat up quickly you put them here, right?

P: Yes, the griddle heats up quickly.

E4: But does one part get hotter than another? Or is it more or less the same?

P: First it heats up in this part and then here.

E4: Yes, and if it's still on right now and you want to put something, do you always put it here?

P: Mhm.

E3: Ok, thank you very much.

P: Ok, no worries.

E3: For me it's ok, ¿Quique?

E4: There, is good.

E3: Ok. Do you have any questions? Anything else you want to tell us about the topic of the cooker?

P: No, no.

E3: Ok. Thank you very much.

P: Ok, no worries.

INTERVIEW 13

1. PRESENTATION

E: Your husband?

P: I don't have a husband.

E: You don't have a husband?

P: I am a single mother, is juts my father and my mother with me.

E: How old are you?

P: My father is [above 70].

E: And your mother?

P: [above 65]..

E: [above 65].. Your children, [10-15]? One is [10-15] years old?

P: One is [10-15] years old, he is not my son, he is my nephew, who is with me.

E: Ohh! And he is 10?

P: He is [10-15] and my son is [5-10].

E: Ok.

P: They're both boys.

E: Ok. Perfect. What does the family do for a living?

P: For example, now we toast coffee.

E: Toast coffee?

P: Since there isn't much work in the coffee field, just weaving.

E: Ok, perfect. Ms. Maria, you are responsible of cooking?

P: What?

E: You are responsible of cooking? You have to cook?

P: Yes, me and her.

E: Perfect. To cook, what kind of firewood do you use?

P: Pine.

E: Pine. Ok.

P: Cypress, maybe. I have been changing the firewood.

E: Right. How long have you had the stove for?

P: I don't remember, maybe 2 or 3 years.

I: 3 year.

P: 3 years, I think.

E: 3 years. Ok.

P: Yes.

E: Perfect. And, how many times do you use it during the day.

P: Only in the morning, sometimes I cook my beans there, there is fire all day there.

E: Ok

P: Sometimes I cook my beans, just my food, my coffee.

E: Ok.

P: Yes, heat up the tortillas.

E: They food is breakfast or lunch or... ...?

P: Breakfast, lunch and dinner. All three meals.

E: You cook them on this stove?

P: Yes.

E: OK. Well...I see that you also have a small fire. You use that as well, for what?

P: To make tortilla.

E: Ok.

P: Skillet, clay skillet.

E: And, since when do you use the open fire?

P: What?

E: How long have you been using the open fire?

P: That? The normal?

E: Yes

P: I just used it

E: But have you used it for many years, 5 years, 10 year, since when?

P: Since I was born, that was the only thing my dad used. Yes

E: Ok.

P: When they gave me the griddle, that is way I am using the griddle.

E: Perfect.

P: Because I am saving a little of firewood, because there isn't much firewood...I use that stove.

E: You feel like you save up firewood when you use the other stove?

P: Ooh yes!

E: Ok.

P: Oh yes, I put 3 firewood or 2 firewood.

E: And, is that enough?

P: Yes

E: Perfect. Your firewood, how do you get it? Do you buy it, or you collect it?

P: What, I mean we have a tree.

E: Oh!

P: Yes, we get the firewood, we have trees

E: Oh ok. From the land around, that is where you collect it from?

P: Yes, we have it on the land given to us. We don't buy.

E: And, how do you get there? walking? Or, do you have...?

P: Walking

E: Walking?

P: Yes, carrying the firewood all the way here because a car cannot enter here

E: And, how long does it take you to get from here to there?

P: Like 20 minutes.

E: 20 minutes, ok. How much firewood do you use per week or per month?

P: Per week like 1 load or half a load.

E: 1 load per week, half a load. Ok. For how long have you used your stove today?

P: For how long?

E: Aha. How many hours have you cooked in the stove you have here?

P: This morning? All day

E: Since what time?

P: Because there are my beans. So, my beans cook.

E: At what time did you start today?

P: At...at 6:30

E: At 6 and, you haven't turned it off until now?

P: No, because I made my tortilla, my food. At 8 it had nothing, and I put my beans until now... that the fire is on.

E: Ok, perfect

P: Yes

E: How long does it take you to make breakfast?

P: Like 1 hour.

E: 1 hour.

P: Yes.

E: What about lunch?

P: The same for lunch.

E: 1 hour, and, dinner?

P: Dinner too.

E: Dinner 1 hour. It takes you 1 hour for everything.

P: Yes

E: Ok. And so, you use it more when you cook beans?

P: Yes

E: Or nixtamal?

P: With that too.

E: How long?

P: I also make tortillas from the nixtamal there, then I put my atole. And that is how I use up the time.

E: Ok. And, how often do you cook nixtamal?

P: Everyday

E: Everyday?

P: Yes

E: And, how long does it take you to cook it?

P: Like 1 hour

E: Like 1 hour, Is it ready in 1 hour?

P: Yes

E: Ok, perfect. And, the beans? How often do you cook beans?

P: Sometimes every day because...yes.

E: Ok, perfect. To cook, do you use any type of special pots? Clay, metal, aluminum?

P: Just clay, and the filter of... how is it called?

E: Pewter?

P: Pewter

E: Ok.

P: Of...of aluminum.

E: Ok, fine. Do you cover your pots when you cook?

P: Just when it is like this.

E: Do you sometimes cover them or not?

P: Yes, when its cooking yes...yes, I cover them.

E: Ok. So, sometimes yes, sometimes no?

P: Yes

E: OK. And...do you remove the ashes form your stove or is it not necessary?

P: What do you mean?

E: The ashes that come from...

P: Oh, yes! I'm keeping it to use it as a fertilizer

E: And, how often do you remove it? How often do you take it out?

P: Every 2 days.

E: Every 2 days?

P: Yes

E: And, for example, the chimney, do you have to clean it or it not necessary?

P: Yes, everyday

E: You clean the chimney every day?

P: Yes

E: Ok.

P: Because the smoke doesn't come out sometimes.

E: Right.

P: Yes

E: Besides from cooking, do you heat up water for bathing? In your stove?

P: Us in temazcal.

E: You have a temazcal?

P: Yes

E: Ok. Perfect. What do you like about your stove?

P: What do you mean?

E: What do you like?

P: I liked it...because when one cooks its beans, I take them out of the burner and put them there and leave them there and I am saving up a little of firewood.

E: You like it that it uses less firewood?

P: Yes

E: And with the beans, why does it take so long? Why does the beans take so long?

P: Yes, because they don't cook fast.

E: And, what do you not like?

P: I like everything, with the stove, I like it because, I like that you can put things there. I liked it.

E: Ok, fine. Well, Ms. Maria, that was all for me.

P: Ok.

E: So, P and E will ask you further questions and then we will be done.

P: Thank you.

E: Yes, ok.

E2: So, our questions are more about to see the use you give to the cooker, and how it could be improved and all that.

P: Yes

E2: So, it's just the two of you, right? At home, that's all?

P: Yes, just 2.

E2: Perfect. And the cooker, what does it have? The improved cooker, you bought it 3 years ago? You bought it?

P: Oh, I don't remember, like 150, I think.

E2: Oh, so you already paid for it?

P: Yes.

E2: And, do you remember who you bought it from?

P: 150 or 50, I don't remember much because...

E2: Was it with [NGO]?

P: Yes, in the bank we dropped it off.

E2: Super. So, you did the training program?

P: Yes.

E2: Oh, great! And the cooker, how did you decide you were going to use this one? How did you decide that you would stop using the open fire and start using the new one? How did that happen?

P: When... when this one isn't here.

E2: Yes? Before, how did you know?

P: I don't have a griddle...

E2: You didn't have...

P: I have these, like this, look. There are improved griddles, they call them. They have cement below.

E2: But, where did you see that? How did you know about that? Did you see it from a friend, neighbor or is it the people from the Puente program that came to let you know...?

P: With the program, I went to get it to Patzun.

E2: The program built it?

P: I think that... it's the president that gave us that, but years ago. I don't remember.

E2: Yes, no... not long ago.

P: Right.

2. USE

E2: Ok. Do you still use the old pots you used before?

P: Yes.

E2: You can use them without any problems, right?

P: Yes, thank you.

E2: Ok, super. So, you use the... this firewood that's good... or sticks that you search for here, right?

P: Yes.

3. INFORMATION

E2: You don't buy it? You search for it, you collect it?

P: No.

E2: You collect it.

P: Yes.

E2: How did you install this improved stove? Did someone come to install it?

P: No, they only taught us at the school.

E2: Yes?

P: I went to get the stove to the school, and someone taught us how to install it.

E2: How to install it and how to use it.

P: Yes.

E2: Super. Regarding the use and installation. Very well. So, it was easy to install it and begin to use it?

P: Yes.

4. ADOPTION

E2: That's great! And another thing, what would you say... what would you say are the advantages? Now, well, you still have both and use the open fire once in a while.

P: Yes.

E2: If you compare them, to you, what are the advantages or disadvantages, the positive or negative aspects of using the improved one over the... the open fire?

P: It's better to use that, because it saves a lot of firewood.

E2: So, it's mostly that it saves firewood?

P: Yes.

E2: Anything else that's different? That you've noticed?

P: Just that. Yes because, like I said that one, when I cook my beans, I take out my burners and put my clay pot here, see? And I put my pot there, see? So, I don't waste much firewood.

E2: Right, on that one you couldn't do that?

P: Yes. Just because my beans are cooked, I put it over here and would rather put it.

E2: It's not hot now? You're touching it with your hands? It's not hot?

P: No, it's not hot.

E2: Oh, no? How do you do it! How are you in terms of smoke? Does a lot of smoke scape here?

P: Yes, a lot of smoke comes out, I don't know why or because of the chimney that's here or...

E2: Right.

P: A lot of smoke comes out when I put my firewood.

E2: But would you say, that this one produces more smoke than, this one?

P: This one consumes more. Because when I want a tortilla, I make my tortilla there.

E2: Right, but which one has more smoke? When you use this one, or this one?

P: Oh, this one! Anyway, it doesn't produce much smoke. Yes, but I am using my griddle and it helps me a lot because I only warm up my tortilla, I heat it up here.

E2: Yes, yes, yes. Ok. I understand. So, it's other issues, but both: the open fire and this one, both have smoke, right?

P: Yes.

5. HEALTH

E2: Another thing about your health, and your physical state. How do you feel?

P: I'm not doing well, miss.

E2: Are you sick? Do you feel sick?

P: Yes, it's been almost... almost 2 months.

E2: Of what? What do you have?

P: It's just that the doctor said I was... I have high pressure, that's what's wrong with me. And I can't find medicine for that! Sometimes I feel pain, I feel like an attack to my head. I get a fever, I get a cough, I don't eat much anymore, that's why I'm sick right now. I'm sick right now.

E2: I'm sorry to hear that, that you're sick. And do you feel weak?... You help your mother, right, I suppose?

P: She only makes my tortilla, I can't make tortillas, I feel like I'm going to fall on the griddle. Yes.

E2: Oh! I hope you get better soon.

P: Huh?

E2: I hope you get better soon.

P: Yes, that's what I'm asking God who gives me health.

E2: Ok. And in terms of... last question and then we won't bother you anymore.

P: Yes.

6. SAFETY

E2: Regarding accidents, have there been any burns or things like that, because of using this one?

P: No.

E2: No accidents. You're always watchful and... that's great!

P: No accidents thank you, because the little ones almost don't come in here and since that doesn't... they can't get burned because it has that little board.

E2: Of course.

P: Almost none. Yes.

E2: Ok, great. Do you want to ask us a question? Or is there anything else you would like to share or say? Regarding this, your cooker or something.

P: Thank you for coming with me. Yes, because the miss talked to my sister yesterday and told me that... they were coming to give us an appliance, if you agree. And like my sister is also using this, but like she said it's better if they come with you, that's why I'm happy to see that. I was sad because you weren't coming.

E2: Oh, no!

P: She said 2 in the afternoon. You weren't coming.

E2: Yes, we're here...

P: I feel very happy that you gave me my lamp. I don't have my own light; I'm renting a little. Thank you for giving me my lamp.

E2: I'm glad it can help and serve you!

P: May God bless you.

E2: You can... don't forget to put it under the sun with direct light on top. If you don't want to crank it, if you feel a little weak, you can do it, right? Crank it? Otherwise with the outlet issue, a neighbor can lend you...

P: Thank you for coming with me. Maybe there will be another opportunity.

E2: Yes.

P: I'm always in need, because I don't have a husband and he only left me 2 children. But I am also happy because I have 2 children and if I die, they stay here. That's just my word and I thank you so much for giving me this lamp. Thank you, very kind of you.

E2: It's nothing. Good. So, your sister also uses the cooker?

P: Yes, she does.

E2: She used it... did she start using it after or before you?

P: She's all the way down there.

E2: And who had it first, her or you?

P: The same.

E2: At the same time?

P: Yes, at the same time. We're about 24 or 24 women.

E2: That's great!

P: Yes. But, so not everyone gets one? Or everyone?... Oh.

E2: Only yours.

P: Oh ok, thank you very much miss. Very kind.

E2: No, thank you for your time.

P: For giving me my lamp, and I'm going to use it.

E2: Yes, let's hope it's useful.

P: Yes, well, thank you, very kind.

E2: It will work, we tried it and it works and I hope...

P: Yes, thank you miss.

E2: Thank you for all the information.

INTERVIEW 14

1. PRESENTATION

E: What type of firewood do you use in your stove Mrs. E?

P: A little cracked and a little big.

E: Racked?

P: A little cracked.

E: Oh! But what type of firewood is it? Pine, oak, rubber?

P: Pine and oak.

E: Pine and oak. How old is your stove? 1 year, 2 years, less than a year, 3 months? It doesn't need to be exact.

P: I don't remember.

E: Is it a year old already?

P: Maybe 2 year.

E: 1 year.

I: More!

P: More?

I: You got in the first year. 2017. So then...

E: 3 years?

P: I don't remember.

E: How many times per day do you use your stove?

P: 3 times.

E: 3 times. You cook breakfast, lunch and dinner there?

P: Yes.

E: Ok. Do you have another stove besides this one, or just this one?

P: Just this one.

2. USE

E: Just this one. Do you buy or collect your firewood, Mrs.E?

P: Sometimes we buy and sometimes we just... (inaudible)

E: Ok. How much firewood do you buy?

P: 1 load.

E: 1 load per month?

P: Yes, right.

E: How much do you collect? Do you buy a load, or about how much do you collect?

P: Mmm, I don't know about that, just my husband.

E: More or less, about how much does he bring? Does he collect... half a load, 1 yardstick or loads?

P: 1 load.

E: 1 load as well, he collects 1 load per month. Ok. When he buys the load, how much does it cost?

P: 150.

E: 150 quetzales. How much firewood do you use per month?

P: I sure don't know that.

E: You can't tell me how much you use per month. 1 load is enough for the month or do you use up the 2 loads, the one you collect and the one you buy?

P: Sometimes more, yes because here on the griddle...stove sometimes I put of firewood... (inaudible)

E: Ok. So, you use 2 loads per month?

P: Probably. I sure don't know that.

E: You don't know?

P: Yes.

E: Ok. When you collect, do you go walking?

P: Yes.

E: And how long does it take you to get there? To get there from here, all the way over there.

P: Oh, about half an hour.

E: Half an hour. Ok. Today, how long did you cook on your stove Mrs. Elida? How many hours did you cook today?

P: I don't know.

E: At what time did you start? Did you start in the morning? Have you not turned it on today?

P: Just in the morning.

E: In the morning, about how much time, from what time to what time did you use it?

P: At 6:30.

E: You started to use it at 6:30.

P: At 7:00 I... I turned it off.

E: Ok. Right. How long does it take to make breakfast?

P: Sometimes 1 hour and a half because sometimes I make my food, my atole and after I make... and after I make my tortilla.

E: And, lunch, how long does it take you to make it?

P: Sometimes I just quickly make an egg and that's it. Less than an hour, I think.

E: Ok. And dinner?

P: Dinner, just like my breakfast.

E: 1 hour and a half?

P: Yes.

E: 1 hour and a half. Perfect. For cooking, do you use a special type of pot? Aluminum, clay, pewter?

P: Just like this, like this one.

E: Only pewter?

P: Yes.

E: Ok. Your pots, do you cover them when you cook, or it isn't necessary?

P: Yes.

E: And the ash from your stove, do you leave it or take it out? Do you clean it out or leave it there?

P: Yes, we take it out.

E: How often do you have to do that?

P: Depending on how it's done, of what's-his-name my husband here. Sometimes I have like a bucket here.

E: Ok.

P: A week ago.

E: Once a week.

P: Yes, my bucket fills up and he throws it there.

E: But, do you take it out daily and put it there?

P: Yes.

E: Oh! You take it out daily.

P: Because if I don't take it out it will make me... (inaudible)

E: Ok, and this chimney, do you need to clean it out, or it's not necessary?

P: Yes.

E: How often?

P: When I notice that my smoke isn't escaping, I clean it.

E: Every week, every month?

P: Every month.

E: Every month. And besides cooking, do you heat water for bathing?

P: Yes, sometimes we heat it and sometimes we don't need it.

E: And you heat water for this one... do you cook food for the animals? Or that doesn't cook food for the animals?

P: No.

E: Ok, uh... what do you like about the stove Mrs. E?

P: I like this one better.

E: What do you like? Anything you like?

P: What do you mean? I don't understand.

E: What do you like about the stove, what do you think is nice?

P: Well, I like to use this one.

E: Why do you like it?

P: Because I save more with my firewood.

E: You save firewood. And what do you dislike?

P: What do you mean?

E: What do you dislike, what's wrong with this stove?

P: Nothing is wrong with it.

E: What would you improve? Something it could have, for it to be bigger, for it to have bigger mounts, for it to have another burner.

P: You mean like a little big or...or... like saying... well what can be changed we would have to see.

E: Ok. Well that's all on my part Mrs. E. So, E and P are going to ask you some additional questions and then we will leave. Thank you.

E2: Good afternoon, how are you? I'm P.

P: Fine, thank you. How are you?

E2: Fine thank you. And your name is E?

P: E.

E2: E. We won't bother you for long because we know it's almost nighttime, this is E my colleague.

E3: How are you?

P: Hi.

E2: So, just to follow up a little on what V asked. Maybe the questions will be a little similar, to see how we could improve your... understand better about the use of your cooker and how it could improve. So, how many children do you have?

P: Just 1.

E2: Ok, great. And this is the only place where you cook.

P: Yes.

E2: Ok, super. And this cooker you've had it about 2-3 years and, did you buy the cooker?

P: Excuse me?

E2: Did you buy it?

P: What did I buy? The griddle?

E2: Yes, the griddle. Did you buy the cooker?

P: Miss, what is she saying?

E2: Was it with the [NGO] program?

E3: Yes, 150 quetzales.

P and I speak in Mayan language.

P: 150.

E2: Oh, right, you bought it in the same program?

P: Yes.

E2: And, you attended the training program then, right? [NGO]?

P: Yes.

E2: So how did the idea come about... had you heard about this griddle before you began the training program? Had you heard about this griddle?

P: Yes.

E2: Or did you know anyone who had the griddle? A neighbor, friend, family member.

P: No.

E2: So, you knew about the griddle, you learned with the training program.

P: Mhm

E2: Mhm. Ok, thank you. So then, you said that you use or collect the firewood, both, right? Mhm. The pots that... the pots that you used... that you use.. before having this, you had an open fire?

P: No, it is closed, and I just put it here.

E3: No, but before.

E2: No before, how did you cook before?

P: That... I just had my... what do you call this made of mud.

E2: An open fire.

P: Yes.

E3: Yes.

P: Just like this.

E2: Was there a roof as well or not, was it open?

P: Yes.

E2: It used to be an open fire?

P and I speaking in Mayan language.

I: There was a time that she had her roof and there was a time she didn't.

E2: Mhm. Ok.

P and I speaking in Mayan language.

I: Yes, it was an open fire.

3. INFORMATION

E2: Ok, thank you. And when this cooker... when it arrived... did someone help install it? The cooker.

P: Yes, they helped me bring it here.

E2: And, did you know how to use it? Did you know how to use it, what to do?

P: Oh, yes!

E2: How?

P: They taught me a little. And that's how.

4. ADOPTION

E2: Ok, super. So, to wrap things up more or less. If you compare before when you had an open fire and now, to you, what are the best advantages or disadvantages?

P: This one is better for me.

E2: And if you compare it to the previous one. What's the difference?

P: That wastes more firewood, like the smoke, it holds out... and like that more or less...

5. HEALTH

E2: More firewood. Anything else? Have you noticed a difference in your health, something that changed in your health?

P: Yes, a little better because there isn't any more smoke... there isn't much.

E2: And what did the smoke do to you?

I speaks in Mayan language.

P: Headaches or...

E2: Now you feel that you're coughing less.

P: Mhm.

6. SAFETY

E2: No...I'm asking because there are people who feel more affected in their eyes, others on their skin. Each one reacts differently, right? But here you say head, cough. Ok perfect. Regarding accidents, or fires, did you have any before with the open fire? Or did the children get burned?

P: No.

E2: No, never any accidents.

P: No.

E2: Super, I think we're done here, what do you think?

E3: This is fine.

E2: Mrs. E, thank you so much for your time, truly. For all the information and your time. We're sorry to be bothering you at this hour of the day.

INTERVIEW 15

1. PRESENTATION

E: What is your name, miss?

P: F.

E: F.

E: I'm going to ask you a few questions, Mrs. F and then we'll be done. Afterwards E and P will ask a few more and then we will leave. How many people live in your house, Mrs. F?

P: 5.

E: 5. How old are they?

P and I speaking in Mayan language.

I: [10-15].

P: [10-15].

E: Yes.

P and I speaking in Mayan language.

P: [5-10].

E: [5-10].

P and I speaking in Mayan language.

P: [0-5].

E: [0-5].

I: Husband?

P: Speaking in Mayan language...

E: [35-40]. And you?

P: [35-40]

E: [35-40], perfect. What's the name of the child with the device?

I: Speaking in Mayan language.

P: L.

I: L.

P and I speaking in Mayan language.

E: Ok. Is L her last name?

P and I speaking in Mayan language.

P: L.

E: Ok, fine. What does your family do, Mrs. F? Agriculture?

P and I speaking in Mayan language.

I: He works in agriculture with coffee or with anything they tell him.

E: Ok, perfect. Are you responsible for cooking?

P and I speaking in Mayan language.

I: Mhm.

E: Ok.

P and I speaking in Mayan language.

E: What type of firewood do you use for cooking, Mrs. F?

P and I speaking in Mayan language.

E: Pine, oak?

I: Yes, both.

P and I speaking in Mayan language.

E: Pine, oak?

I: Mhm

P and I speaking in Mayan language.

2. ADOPTION

E2: Ok. Thank you. Did you notice any changes between the cooker you had before...the open fire and this one? And yes...what are the advantages and disadvantages of this one? And if anything, change physically, in your health or accidents...

P and I speaking in Mayan language.

I: She says that she finds this stove better because with the open fire thing would burn, since the fire was going direct so, her things or whatever she was cooking would burn. She never had an accident of her or her children burning. But she prefers this one because it is faster and does not have much smoke,

E2: Ok thank you. Could you ask her if she has any question for us or something she would like to say.

P and I speaking in Mayan language.

I: No.

E2: Ok, then, thank you very much.

E3: Thank you very much.

E2: Thank you very much for you time. We apologize for the time; we are sorry we came so late.

P and I speaking in Mayan language.

