

FINAL REPORT
August 2019

Project Name	ADOPTION OF ECOLOGICAL ROCKET STOVES BY 300 FAMILIES TLAMACAZAPA, GUERRERO
Project Country	MEXICO
Implementing NGO	Atzin Mexico www.atzin.org atzinmexico97@gmail.com
Project Dates	June 2017 – August 2019

This final report provides an overview of the project and the findings of the baseline study.

SECTION ONE: OVERVIEW

Project Goal: Families in Tlamacazapa, Guerrero, Mexico (population 6,200 Census 2005) will reduce fuel consumption and smoke emission with improved air quality, better overall family health and less pressure on the surrounding forest through the incorporation of an ecological rocket stove in their households and cooking practices.

Objective 1: Stove Distribution, Education and Use. To identify and work with 300 impoverished families who cook over a three-rock fire in order to introduce an ecological rocket stove to each family, following a signed agreement regarding attendance at an education class, permission to conduct pre- and post interviews, and take a photograph of the current cooking area with the stove.

Objective 2: Stove Program Monitoring and Evaluation. To monitor and evaluate incorporation of the ecological stove in 300 family households, and to quantify time and fuel consumption with the use of a monthly tracking calendar for 40 selected families of the 300.

Justification. The majority of families in Tlamacazapa cook over a three-rock fire, making weekly trips to gather firewood into the surrounding forest. Ecological rocket stoves use up to 60% less fuel and emit 70% less smoke¹ when compared to cooking over an open fire, thereby reducing consumption of natural resources and toxic smoke inhalation as well as allowing faster cooking time by using just small sticks for fuel.

The proper use of a rocket stove frees up considerable time for family members, especially for women cooks - time that can then be spent on other activities. This project focused on the poorest families, most "new to Atzin" and introduced an ecological alternative for more efficient cooking and time savings.

Beneficiaries and Results

¹ <https://ecozoomglobal.com/>
<https://www.youtube.com/watch?v=8D7rlyqZC6U>

1. 300 families living in acute poverty received an ecological rocket stove as well as training on its proper use. The majority of these families were young and had not worked with Atzin previously.
2. Seven young women, all local promoters had paid part time work for six-twelve months; increased knowledge about their village conditions through home visits to families; training on the benefits of ecological stoves and increased awareness about their surrounding forest environment; as well as, better understanding about the process of program implementation and research.
3. Atzin team members who supervise and monitor development programs have increased understanding of the purpose and design of program studies as well as hands-on experience regarding its implementation and findings.
4. Atzin program supervisors have specific findings and recommendations from the ecological stove study that can guide future program development as well as the opportunity to share these findings with other rural agencies.

Outputs Achieved

- **Planning of project overall design** and implementation.
- Identification of **criteria for selection** of families:
 1. poorest families;
 2. preference for families that had not participated in Atzin programs previously (i.e., families unknown to Atzin);
 3. younger families;
 4. had not had a stove before;
 5. willing to sign a project agreement.
- **Design of interview questionnaire.** Design of monthly monitoring fuel calendar.
- **Initial visits** to 335 families; 300 families selected.
- **Pilot testing** of interview questionnaire and fuel calendar, with revisions.
- **Training of stove project team** in Tlama – all village young women, all part-time (2 interviewers; total of 3 calendar monitors; 2 educators)
- **Family agreements** signed. Interviews done with photos taken of kitchen area.
- **Interviews.** 300 pre-stove interviews of stove recipients. In all but one case, the recipients interviewed were also the main cook of the family. 196 families from Santiago barrio; 69 families from San Lucas; 35 families from San Juan – number of families in each barrio is proportional to the population in each barrio. Data for pre-stove interview questionnaires entered using Excel, and verified.
- **Stove Education.** All 300 women attended one class on stove care and use, in groups of 12-18 women, with an average of 13 attendees in a class. Each received a stove and an illustrated handout. A total of 22 classes were done. A total of 320 stoves distributed: of the 300 families, 20 families received two stoves, 280 families received one stove.
- **Monitoring Visits.** Selection of 40 representative families for monthly calendars (20 with 2 stoves; 20 with 1 stove). Weighing of typical wood load; recording of expense if wood is purchased. Visited at least monthly, many were visited every 2 weeks because of illiteracy levels in the family. 26 families from ST; 8 families from SL; 6 families from SJ. Number of families selected for calendars proportional to population in each barrio.
- **Post-stove interviews.** 160 post-stove interviews completed, with data entry completed and verified.
- **Production of final report** with distribution to Atzin Mexico, Atzin Canada and Rotary Club Lethbridge plus selected individuals.

SECTION TWO: BASELINE DATA ON INTERVIEWEES - STOVE RECIPIENTS

299 women (99%) received an ecological (rocket) stove for the first time. One woman had had a stove several years before but had given it away to a relative, and was included in the project.

The 300 stove recipients were broken down by age in Table One: 68% of recipients were between 21-40 years of age which reflected our objective of targeting younger families as participants. This percentage rose to 74% if the recipients between 15-20 years of age are considered. 24% of recipients were over 40 years of age.

The location of recipients' houses as seen in Table Two reflects the population figures by neighbourhood (*barrio*) of the total village, a deliberate characteristic of the stove project design.

Table One: Age breakdown of 300 interviewees

Age In years	# of interviewees (total 300)	% of total interviewees	%
15-20	18	6	6
21-25	44	15	34
26-30	56	19	
31-35	52	17	34
36-40	52	17	
41-45	34	11	18
46-50	21	7	
51-55	12	4	8
56+	11	4	

Table Two: House Location of 300 interviewees

<i>Barrio</i> (Neighbourhood)	# of interviewees (total 300)	% of total interviewees
Santiago	200	67
San Lucas	67	22
San Juan	33	11

Literacy

When asked about their literacy ability, 30% of stove recipients reported that they could read while 29% said that they could write. Of the 300 women, 71% could not read or write to a functional level. These figures are very similar to the findings of Atzin's village census done in 2005.

Table Three: Literary capacities of 300 interviewees (self-reported)

Literacy	# of interviewees	%	# of interviewees	%
	Responded "Yes"		Responded "No" or "A Little"	
Can READ to functional level	89	30%	211	71
Can WRITE to functional level	88	29%	212	71

- More than half of respondents (58%) never attended school.
- Ninety-one women (30%) attended primary school only, with 48 (16%) completing grade six.
- Twenty-five women of the 300 went to junior high school, with 17 (6%) finishing grade nine.
- Two women (1%) had attended high school.
- Eight (3%) had attended Atzin's literacy program, *Tihueliske* for Adults.

Table Four: Formal education of 300 interviewees (self-reported)

Level of schooling completed	# of interviewees	% of 300 women
Never went to school	174	58
Grade 1 Primary	6	2
Grade 2 Primary	15	5
Grade 3 Primary	10	3
Grade 4 Primary	8	3
Grade 5 Primary	4	1
Grade 6 Primary	48	16
Grade 7 Junior High	0	0
Grade 8 Junior High	8	3
Grade 9 Junior High	17	6
High School	2	1
Tihueliske Community Education Atzin	8	3

House and Population on 300 Land Lots

The recipients of stoves lived in houses located on a portion of a land lot. Each woman was asked about her house, her land plot, and the number of houses on the total land lot.

72 women (24%) had only her house on the land lot, while 163 women (54%) had two or three houses on the one lot.

55 women (19%) had 4-6 houses on the land lot, while 10 women (4%) had 7-8 houses on the lot.

Keep in mind that all lots were small in size,² and the lots with four or more houses were considered to be very crowded. The total number of houses was 791 on 300 land lots, with most of these houses sheltering a nuclear family.

Table Five: Number of houses on 300 land lots

Number of distinct houses	Number of interviewees	% of interviewees	Total number of houses on 300 land lots
1 house	72	24	72
2 houses	101	34	202
3 houses	62	20	186
4 houses	26	9	104
5 houses	18	6	90
6 houses	11	4	66

² Actual measurements of each lot were not included in the questionnaire. This type of question would have provoked distrust about our intent.

7 houses	9	3	63
8 houses	1	1	8
TOTAL	300 women	%	791 houses

Interviewers pointed to each house on the lot, asking recipients to indicate how many families lived in that specific house. 62 women (21%) reported one family on the lot; 160 women (53%) had two or three families living on the lot. 78 women (27%) had four or more families on the lot; of those, 4 women (2%) reported 8-9 families.

Table Six: Number of families on 300 land lots

Number of families	Number of interviewees	% of interviewees	Total number of families on 300 land lots
1	62	21	62
2	87	29	174
3	73	24	219
4	42	14	168
5	21	7	105
6	3	1	18
7	8	3	56
8	2	1	16
9	2	1	18
TOTAL	300 women	%	836

A related question broke down the actual number of people living on the same land lot. The interviewer asked how many individuals lived in each house, having drawn a map of the lot with each house on the back of the questionnaire and asking how many people lived in each house. This technique increased the reliability of the responses.

A total of 3,072 people organized in 836 families lived in 791 houses on the 300 land lots. A total of 1,315 individuals lived in the 300 houses of stove recipients, an average of 4.4 people per household. However, 41% of HHs had higher numbers of HH inhabitants: 90 households (30%) had 5-6 people, and 31 households (11%) had 7-11 occupants (see Table Eight). Given the small size of houses and lots, these numbers alone indicate a serious problem of overcrowding among the poorest families in Tlmacazapa.

These numbers also suggest that the stove project had a much larger reach than anticipated in terms of people's exposure to this cooking technology.

Table Seven: Number of people on 300 land lots (of all ages)

Number of people who live on lot	Number of interviewees	% of interviewees	Total number of people on 300 land lots
1 person	0	0	0
2 people	5	2	10
3	8	3	24
4	23	8	92
5	18	6	90
6	32	11	192
7	16	5	112

8	32	11	256
9	19	7	171
10	22	7	220
11	24	8	264
12	11	4	132
13	14	5	182
14	13	4	182
15	12	4	180
16	14	5	224
17	4	1	68
18	4	1	72
19	4	1	76
20	0	0	0
21	25	8	525
TOTAL	300 women	%	3,072

Table Eight: Number of people who live in 300 interviewees' households

Number of people who live in interviewee's house	Number of interviewees	% of interviewees	Total number of people in 300 houses
1 person	2	1	2
2 people	35	12	70
3	68	23	204
4	74	25	296
5	47	16	235
6	43	14	258
7	11	4	77
8	12	4	96
9	4	1	36
10	3	1	30
11	1	1	11
TOTAL	300 women	%	1,315 people

Atzin's house by house census conducted by 75 trained village youth in 2005 found a total population of 6,034 people organized in 1,394 families (all data was verified).

This stove study of 3,072 people organized in 836 families in 300 lots is half of the total population counted in 2005 and more than half of the number of families. In contrast, the National Institute of Statistics and Geography (INEGI) household census done in 2005 reported 5,458 inhabitants and in 2010, 6,234 inhabitants, suggesting that the INEGI census was incomplete in coverage on both occasions.

Our finding indicates that the village population has grown substantially despite deaths and outward migration. The need for a repeat and accurate household census is clear given the implications for Atzin programming in future, the need for more government schooling facilities and also, village expansion in available land lots.

Meals and Kitchens

In general terms, the number of people eating together and sharing one kitchen tracked the number of people living in the HH. There were variations in numbers, however, indicating that people from the other houses on the land lot shared a kitchen and meals.

Table Nine: People who eat together, sharing one kitchen

Number of people who usually eat together in house with new stove	Number of interviewees	% of interviewees	Total number of people who eat together in 300 houses
1 person	3	1	3
2 people	46	15	92
3	56	19	168
4	63	21	252
5	47	16	235
6	47	16	282
7	16	5	112
8	14	5	112
9	4	1	36
10	1	1	10
11	3	1	33
TOTAL	300 women	%	1,335

School Enrollment of household members (not including interviewees)

Table Ten summarizes school enrollment of the 1,015 people living in the 300 recipient households in 2017, not including the interviewees.

424 (42%) HH members were young, between the ages of 0 to 12 years, while 181 (18%) were preschoolers aged 0-5 years, meaning that 60% of HH members were 12 years old or less, a high proportion of children.

Of 129 children aged 2-5 years, only three boys attended kindergarten. This likely mostly reflected the poverty level of the families (kindergarten is costly because of uniform, shoes and materials charges although there is no monthly tuition fee) and probably, a related reluctance to spend time walking children to and from kindergarten (instead of working), and in some cases, waiting outside the school

until dismissal time. A low level of awareness about the importance of early socialization and stimulation was also possible.

Of 243 children (103 boys and 140 girls) aged 6-12 years, a total of 183 (75%) attended primary school, and 60 (25%) did not attend.

Of 214 adolescents (107 males, 107 females), 109 (51%) were in school, the majority in junior high/ *telesecondaria*. More females (63, 59% of females) than males (46, 43% of males) had continued studying to junior high level. By the age of 21 years or more (317 people), only 5 (2%) continued in school.

Note that of the 317 people aged 21 years or more in the recipient households, there are far more males than females. 291 are male (73%) while only 86 (27%) are female. We do not have an explanation for this gender skew, and consider that that could only be answered with a comprehensive review of births and deaths records and a decent estimate of outmigration.

Table Ten: Age and Education Enrollment of 1,015 people in 300 households (not including interviewees) by gender

Education	0 to 2 years		3 to 5 years		6 to 12 years		13 to 20 years		21 + years		TOTAL	
	52		129		243		214		317			
	M 25	F 27	M 63	F 66	M 103	F 140	M 107	F 107	M 291	F 86	M 589	F 426
Attend school	0	0	3	0	77	106	46	63	4	1	130	170
Do not attend school	25	27	60	66	26	34	61	44	287	85	459	256

Housing Materials

Interviewers recorded the material construction of the 300 recipient houses by observation. 122 houses (41%) had a dirt floor; 57% had stick walls (either cornstalks or tree branches); 28% had a palm roof (1 HH) or heavy cardboard (27 HHs, *carton*). Roughly half of the HHs have low quality houses and inadequate housing.

60% of HHs had a concrete floor; 42% had brick or concrete block walls; and 38% had either fiber-cement or metal sheet roofs while 30% had poured concrete roofs.

The mix of materials in housing is notable: people improve their floors, walls and roofs gradually as time and money are available or in the case of fiber-cement roofs and concrete floors, when selected for government programs.

A few years ago, a government sponsored "floor program" poured (partial) concrete floors inside an unknown number of palm houses but did not replace walls or roofs. A different "roof program" partially replaced palm and cardboard roofs with fiber-cement sheets on selected houses, but not necessarily the same houses as in the floor program. This helps to explain the irregular numbers and the mix of materials and quality of floors, walls and roof.

Table Eleven: Construction of 300 Interviewees' Houses

House Part	Type	# of interviewees	% of 300 houses
Floor	Dirt	122	41
	Concrete plain or painted	177	59
	Concrete with ceramic	1	1
Walls	Sticks (cornstalks; branches)	170	57
	Bricks; concrete blocks	126	42
	Adobe	0	0
	Mix of materials (Sticks and blocks)	4	1
Roof	Palm	4	1
	Sheets of heavy cardboard	82	27
	Concrete	91	30
	Sheets of fiber-cement or metal (lamina)	113	38
	Tile – low fire clay	2	1
	Mix of materials	8	3

Possession or Ownership of 300 Land Lots

A critical matter for all families is having legal papers for the land on which their house is located. The village lies within territory that is known as *ejidal /terreno comunal* or common land - land that is held in common by the inhabitants. A complicated historical subject dating back to the Mexican Revolution, basically the law was intended to protect the rights of the Indigenous people to land and actually means that no one can be the actual legal "owner" (*dueño*) of land as personal property.

However, over the years within the village, an internal system for "possession" of land has evolved, and with that, a means for holding legal papers. This is done via the village elected *comisariado* (in position for a three-year term, and to date always male) and village assemblies of *comuneros*, selected village men who are supposed to be all farmers (but in reality, only roughly 25% are actively farming).

New land lots on the outskirts of the village are allocated to applicants who live in Tlama for a "measurement" fee. Until very recently, all applicants were male, and each had to pay the measurement fee to the *comisariado* and build a rock/wood wall encircling the lot or risk losing it. The applicant then receives an internal-to-the-village document of "possession." Within the village, lots with possession papers change hands through inheritance and now, most often through sale of the lot with ever-increasing prices.

76 (25%) recipients stated that her husband owned (possessed) the land on which the HH was located, and 71 (24%) actually owned the full lot. Most land plots (120, 40%) and lots (125, 42%) were reported as owned by the recipients' father-in-law, and by other relatives (91, 29%).

Only six stove recipients (2%) claimed ownership over the plot of land on which her house was located, and four of these women owned the entire lot, showing the gender male bias of land ownership within the village.

Important to note, despite statements of ownership that is understood verbally among family members, only 103 (34%) reportedly had papers of ownership/ possession. The high percentage (66%) with no papers frequently confront complicated family dynamics and arguments over land when a

family death occurs. As well, the male ownership frequently leaves women in a precarious position of being homeless when marriages/common law relationships break down.

Table Twelve. Legal/Recognized Possession of Land Lot

Possession	Owner of land lot (relationship to interviewee)	Number of interviewees	% of interviewees
Owner of portion of land lot where interviewee's house is located	Husband	76	25
	Son	1	1
	Father-in-law	120	40
	Grandfather	11	4
	Other relative	80	27
	Tenant (rented)	6	2
	Interviewee-owned (self)	6	2
Owner has legal papers for portion of land lot	Yes	103	34
	No	194	65
	In process	3	1
Owner of entire land lot	Husband	71	24
	Son	0	0
	Father-in-law	125	42
	Grandfather	11	4
	Other relative	83	28
	Tenant (rented)	6	2
	Interviewee-owned (self)	4	1

Sanitation

The sanitation findings immediately pointed to the continuation of a health problem.

- **149 (50%) of recipient households had no toileting facility and always used open-air excretion.** That in itself is a sanitation and health problem.
- 113 HHs (38%) had a badly designed dry toilet constructed by the municipal government in 2009-2010, that was often shared by others on the lot.
- 13 HHs (4%) had a well designed and functioning Atzin dry toilet and rainwater tank unit.
- 25 HHs (9%) had constructed a water-flush toilet that drained into an underground pit, usually a shallow pit that could also increase risk of contamination of village wells depending on distance.

Table Thirteen: Sanitation: Toileting Facilities of 300 Interviewee Households

Toileting facility	Number of interviewees	% of interviewees
Open-air excretion practiced by family	149	50
Dry toilet constructed by government, shared on lot (problematic design)	113	38
Dry toilet constructed by other (Atzin), with rainwater tank, shared on lot	13	4
Water-based toilet, draining into underground pit, shared on lot	25	9

Of the 151 households with some sort of toilet (dry toilet or water based), respondents gave the number of people using the one toilet, which often included neighbours. **On average 8.4 people used one HH toilet, however, the actual number per toilet varied widely (see Table Fourteen) with 38 interviewees stating that 11 to 21 people used their toilet daily.**

Table Fourteen: Sanitation: Number of people using toilet of any type (dry toilet or water-based) (total 151 families of 300 households)

Number of people using toilet on land lot	Number of interviewees (total 151)	Total number of people using toilet	% of 151 interviewee households
1 person	0	0	0
2 people	3	6	2
3	8	24	5
4	11	44	7
5	27	135	18
6	14	84	9
7	17	119	11
8	20	160	13
9	8	72	5
10	5	50	3
11	6	66	4
12	6	72	4
13	1	13	1
14	5	70	3
15	3	45	2
16	5	80	3
17	3	51	3
18	2	36	1
19	3	57	2
20	0	0	0
21	4	84	3
TOTAL	151 interviewees	1,268	

Water Sources by Season and Drinking Water

During the six-month dry season (December to May), 218 recipients (72%) walked to village wells to get water, their principle source of water. 42 HHs (14%) received pumped water from *Los Sabinos* from a tap installed at their lot entrance. (These families had paid for all tap and tubing materials and installation.) 29 HHs (19%) purchased water in cash from a neighbour's tap, and 11 (4%) purchased water from a private water truck.

The main source of water for these 300 HHs changed significantly during the rainy season (June-November) with 180 HHs (60%) catching rainwater from their roofs, usually using a piece of heavy plastic cloth, and storing the water in different, often open (no lid) containers. Only 26% (77 HHs) continued to walk to village wells and 42 HHs (14%) paid for water from their or a neighbour's water tap.

This annual shift in the amount of purchased pumped water (obtained from a tap) in the village overall is disruptive to the whole system because of changes in revenue, labour/maintenance, and organization of the water committee. Note that many of the recipient HHs in Santiago, the most populated *barrio*, are located outside of the pumping system and cannot connect to the pumping system.

Table Fifteen: Main Water Sources: Dry and Rainy Seasons

Season of year	Main Water Source for general household use	Number of interviewees	% of interviewees
Dry Season	Trips to village wells	218	72
	Pumped water via tap on land lot	42	14
	Purchased from neighbour (pumped water with tap)	29	10
	Purchased from private water truck	11	4
	Rainwater catchment from house roof (using any means)	0	0
Rainy Season	Trips to village well	77	26
	Pumped water via tap on land lot	28	9
	Purchased from neighbour (pumped water with tap)	14	5
	Purchased from private water truck	0	0
	Rainwater catchment from house roof (using any means)	180	60
	Other: Lagoon	1	1
Water for drinking and cooking	Village wells	40	13
	Pumped water via tap on land lot	6	2
	Purchased from neighbour (pumped water with tap)	2	1
	Purchased from private water truck	0	0
	Rainwater catchment from house roof (using any means)	0	0
	Purchase of bottled water (20L)	252	84

The interviewees also responded to questions about water for drinking and cooking. These were important questions because of the lead and arsenic contamination of village wells, especially during the dry season. 40 women (13%) said that they used well water for drinking and cooking and never purchased bottled water; 8 women (3%) used pumped tap water, also not safe for drinking.

A very large number, 252 women (84%), stated that they purchased bottled water (20L plastic bottles, *garrafondes*). Most of this water would be filtered, bottled and sold at four "purificadores" installed in recent years in Tlama, and currently sold at 13 pesos per bottle. In-store purchases of water bottled by Coca Cola and Pepsi is sold at 26-30 pesos per bottle and for a large family, is a costly item. Unfortunately, the interviewer did not probe for source of purchased bottled water.

Table Sixteen summarizes women's reports of money spent on bottled water per week. Omitting the 8 HHs that did not specify the amount of money spent each week, 78 HHs (31%) spent between 10-30 pesos per week, thereby having one to two *garrafrones* of bottled water (20-40 liters). 124 HHs (49%) spent between 31-50 pesos, that is, 2-3 *garrafrones* or 40-60 liters of water, while 30 interviewees (12%) spent between 51-70 pesos, or 3-4 *garrafrones* or 60-80 liters of water. Twenty interviewees (8%) spent more than 71 pesos per week.

Several issues are evident: 1) the questions and interview method may not have been adequate for reliable information because many/most villagers now know the "right" answers about the need to purchase water for drinking (but probably do not consider cooking), and would answer accordingly, no matter what the HH was doing; 2) people generally do not understand the difference between bacteria and metals, and that boiling water does not remove metals; 3) it is very likely that the purification facilities do not filter out harmful metals from water or that that filtered water is monitored regularly for contaminants - this issue needs follow-up; 4) the amounts of bottled water reported appear low for family size and adequate hydration, and also, most probably do not take into account water for cooking.

More investigation about water used for drinking and cooking and its cost is needed as are options for obtainment. Atzin had focused on rainwater harvesting as the most feasible technology in previous years as a source of metal-free water as a component of construction of dry toilet and rainwater tank units (DTT), however, our Water and Sanitation Program was halted in 2011 because of the government construction of 500+ badly designed dry toilets and a rapid shift in villager acceptance of dry toilets. That negative attitude has changed recently with individuals asking about the possibility of having a DTT unit constructed.

**Table Sixteen: Usual purchases of purchased bottled water (20L *garrafrones*/bottles)
In one week (self-reported)**

Amount spent in one week on bottled water (pesos)	Number of interviewees (300)	% of interviewees
10-30	78	31
31-50	124	49
51-70	30	12
71+	20	8
Did not specify	8	3
Does not buy bottled water	40	13

Cooking Practices and Facilities

Most interviewees reported that one person (the interviewee) usually did the cooking (228, 78%). 72 women (8%) said that they cooked and others helped in preparation while 47 (16%) said that two people did the cooking (the interviewee and one other).

Table Seventeen: Cooks and Cooking

Cooks	Number of interviewees (300)	% of interviewees
One person (interviewee) usually does all cooking	228	76
One person (interviewee) usually cooks and others help with each meal	25	8
Two people (interviewee and one other) usually cook all meals	47	16

The HH method of cooking was important in this study,

- 253 interviewees (84%) only cooked on a three-rock fire (*fogón*), using firewood for fuel. This is the simplest cooking method, uses the most firewood, and produces the most smoke.
- 31 interviewees (10%) used a half metal drum or clay stove (with or without an exhaust pipe to outside), both with firewood as fuel.
- Sixteen women (5%) reported that they used a combination of three-rock fire and gas stove with a 20 or 30 litre tank.

In baseline pre-stove interviews, information about the amount of gas in the tanks at the time of interview was not obtained.

Table Eighteen: Cooking Facilities

Cooking facility	Number of interviewees (300)	% of interviewees
Three-rock fire (<i>fogón</i>) (uses firewood)	253	84
Gas stove with tank only	0	0
Combination of three-rock fire and gas stove with tank	16	5
Clay stove built into house (Lorena) (uses firewood)	4	1
Metal half drum with grill (uses firewood)	27	9

- Three of the 16 households with a gas stove purchased between 201-300 pesos of gas per refill.
- Eleven households (69%) paid between 285-350 pesos to refill their tank.
- Five households (25%) reported a usual payment of 351-480 pesos.

Usually a tank lasted the family 1-2 months (11 of 16, 69%); 3-4 months (3 of 16, 19%); 5-7 months (2 of 16, 13%).

Table Nineteen: Cost of gas tank refills

Usual cost of gas tank refills (pesos), either 20L or 30L size	Number of interviewees (16)	% of interviewees
285-300	3	19
301-350	8	50
351-400	3	19
401-450	1	6
451 or more	1	6

Cooking with a gas stove is substantially easier and faster, however, the fact that only 16 of the 300 HHs had a stove is a good indicator of their level of poverty.

Low fire glazed cooking pot and dishes

106 interviewees (35%) reported that they did not use clay pots or dishes. However, 194 (65%) interviewees used low fire glazed clay pots or dishes either daily or at times.

This is of serious concern because of the high risk for lead leaching into cooked or stored food with use of these pots and dishes. Any use increases risk of exposure and a consequent buildup of toxins in the body, especially given the pattern of low nutrient diets in the village.

Table Twenty: Glazed clay pots and dishes (very high risk for lead content)

Frequency of use of clay pots and dishes	Number of interviewees who report use of clay pots and dishes (194)	% of interviewees
Once a week	37	19
2-3 times each week	83	43
Daily	57	29
Every two weeks	10	5
Once per month	7	4

Food, illnesses and appliances in the households

Although quantities were not checked by the interviewer during the pre-stove interview, **247 recipients (82%) reported that there was no food in the house nor food stored elsewhere** on the day of interview. These households, operating on survival mode with little family reserves, purchased ingredients on a day-by-day basis or bought prepared food from women selling in street stands.

The other 53 households (13%) had small amounts of food staples in the house. These included: white rice (37 HHs); beans (44 HHs); instant coffee (30 HHs); eggs (6 HHs); sugar (7 HHs); oil (5 HHs); salt (5 HHs); bread (1 HH); vegetables like onions, tomatoes (9 HHs); fruit like oranges, limes (7 HHs). Note that the post-stove endline interviews, the interviewer asked to see the HH food storage area and recorded the actual food items and quantities, thereby verifying all information.

When asked about chronic conditions among members in her household, 64 interviewees (21%) reported illness and 236 (79%) reported none. Of the 64 reports of illness, 38 (59%) were related to diabetes and/or hypertension. The health of family members was not probed.

Electrical appliance and electronic devices

Recipients were questioned about appliances and devices in their household. The most common were cellular phones and blenders and especially, televisions (mostly flat screen).

- Thirty-one (10%) of 300 families had no electric appliances of any type nor a cellular phone.
- 122 households (41%) had a cellular phone while an additional 34 families (12%) had two or three phones. The cellular phones usually operate on a buy-credit basis (as opposed to a monthly plan).
- 187 HHs (62%) owned a blender, a small, useful and more affordable appliance.
- None of the 300 households had a landline phone; 83 HHs (28%) owned a radio; 11 HHs (4%) owned a small refrigerator.
- Not surprisingly, 225 (75%) of recipient interviewees had a television. The federal government (PRI party with President Pina Nieto) distributed free flat screen televisions in 2015 to those women registered with the *Prospera* Program (a national welfare program) throughout the country.

In Tlamacazapa in 2014, 1208 women were registered with the *Prospera* program (note that multiple women in one household can be registered in *Prospera*). In 2019, the *Prospera* program, now renamed *Bienestar*, has been discontinued for most women living in poverty, with the continuation of only the elderly and women with disabled family members as well as scholarship allocations to women who have children in school. This change was reportedly due to corruption within the program (for example, false, double or ghost registrants).

Table Twenty-One: Appliances in 300 Households

Type of appliance	Number of interviewees (300)	% of interviewees
Refrigerator	11	4
Blender	187	62
Microwave oven	2	1
Television	225	75
Cellular phone 1	122	41
Cellular phone 2	29	10
Cellular phone 3	5	2
Radio	83	28
Large speakers (for music or announcements to public)	3	1
No appliances or cellular phones	31	10

Firewood as Cooking Fuel

Interviewees were asked about the number of trips to the forest to gather firewood on a weekly basis and who in the household did this work. Each interviewee showed the interviewer the typical wood load carried by each HH member. This load was then weighed using a portable luggage scale and recorded as a base weight for that HH member.

Of the 300 households,

- 37 HHs (12%) always purchased their wood and did not make gathering trips to the forest. They spent money on firewood but not any time gathering firewood.
- 223 HHs (74%) invested time and effort to gather firewood, and did not purchase firewood.
- 40 HHs (13%) gathered firewood and also purchased supplementary firewood.

A return trip to gather firewood generally takes 4-5 hours on average, counted here as a person day. The work includes walking into forest, gathering deadwood, cutting and bundling the wood, and then carrying the load back. Few families in general own donkeys or horses to carry the load, and people usually carry firewood strapped to their backs. Machetes are used to cut wood into bundle size sticks (and almost no families own an axe). People forage for manageable size sticks to bundle, and do not to carry large logs or trunks.

A full load of firewood for purchase usually costs 80 pesos, although the price can vary depending on the season and seller.

A typical load of firewood weighed between 36 to 41 kilograms in 133 (51%) of the 263 HHs that gathered or purchased wood, and was carried by older male adolescents or men.

The typical loads of 60 HHs (23%) weighed 26-30 kilograms. The smaller typical loads, weighing between 10-25 kilograms, were reported by 65 HHs (25%) and were usually carried by women or adolescents.

Green or wet wood weighs more than dry firewood. Some families stock up on firewood during the dry season if there is storage room in the lot as more sticks of wood can then be carried in a load.

Table Twenty-Two: Weight of typical load of firewood by 263 households that GATHER or PURCHASE wood

Weight of typical load of firewood (kg)	Number of interviewees (263)	% of interviewees
10-14 kg	5	2
15-20	29	11
21-25	36	14
26-30	36	14
31-35	24	9
36-40	92	35
41+	41	16

The 37 interviewees who reported that the HH only purchased firewood also had a range of weight for a typical load with 29 HH (78%) weighing between 26-41 kilogram. Half loads were considered to be 15-20 kilograms, with an adjusted price for purchase.

Table Twenty-Three: Weight of typical load of firewood by 37 households: families that ONLY PURCHASE wood

Weight of typical load of firewood (kg)	Number of interviewees (37)	% of interviewees
10-14 kg	1	3
15-20	4	11
21-25	3	8
26-30	6	16
31-35	7	19
36-40	12	32
41+	4	11

When asked about firewood gathering, the 263 respondents answered in terms of number of trips into the forest, with each person walking into the forest and carrying out a load counting as one trip/one-person day.

A staggering total number of 694 trips per week were reported by those who gathered firewood. Each trip represented one heavy work day of 4-5 hours per person, with each family having a designated people who did this work, either by individually (always men) or in small groups of 2-3 people. **The 694 trips per week roughly represent 20,820 kilograms being extracted from the forest each week by the 263 HHs, using a conservative weight of 30 kg/load.**

The majority of the 263 HHs made 1-2 trips to the forest each week: 163 HHs (62%). 83 HHs made 3-4 trips (31%) while the remaining 17 HHs (7%) made 6-10 trips. For the HHs making 6+ trips, it may be that some of this wood was later sold but that question was not asked during the pre-stove baseline.

**Table Twenty-Four: Weekly trips to gather firewood in 263 households:
families that only gather firewood (223) plus families who gather and purchase firewood (40)**

Number of trips per week	Number of interviewees (263)	% of interviewees	Number of person days of work per week
1	64	24	64
2	99	38	198
3	40	15	120
4	43	16	172
6	4	2	24
7	3	1	21
8	1	1	8
9	3	1	27
10	6	2	60
Total number of person days to gather firewood by 263 families in one week			694

The findings for the 223 families that only gathered firewood and did not purchase wood were similar to those when all firewood gathering families were considered. 135 of 223 HHs (61%) made 1-2 trips each week, while 73 HHs (33%) made 3-4 trips. A total of 604 trips /person days were made weekly by the 223 families.

**Table Twenty-Five: Weekly trips to gather firewood in 223 households:
families that ONLY gather firewood and do not purchase firewood**

Number of trips per week	Number of interviewees (223)	% of interviewees	Number of person days of work per week
1	48	22	48
2	87	39	174
3	36	16	108
4	37	17	148
5	0	0	0
6	3	1	18
7	2	1	14
8	1	1	8
9	6	2	56
10	3	1	30
Total number of person days to gather firewood by 223 families in one week			604

Looking at the 40 HHs that gathered and purchased firewood in terms of weekly trips, the numbers predictably shifted with the majority only making 1-2 trips and with 10 HHs (25%) making 3-4 trips.

**Table Twenty-Six: Weekly trips to gather firewood in 40 households:
Families that gather firewood AND purchase firewood**

Number of trips per week	Number of interviewees (40)	% of interviewees	Number of person days of work per week
1	17	43	17
2	11	28	22
3	4	10	12
4	6	15	24
5	0	0	0
6	1	3	6
7	1	3	7
8	0	0	0
9	0	0	0
10	0	0	0
Total number of person days to gather firewood by 40 families in one week			88