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Elevated Stoves in Cerrito, Paraguay

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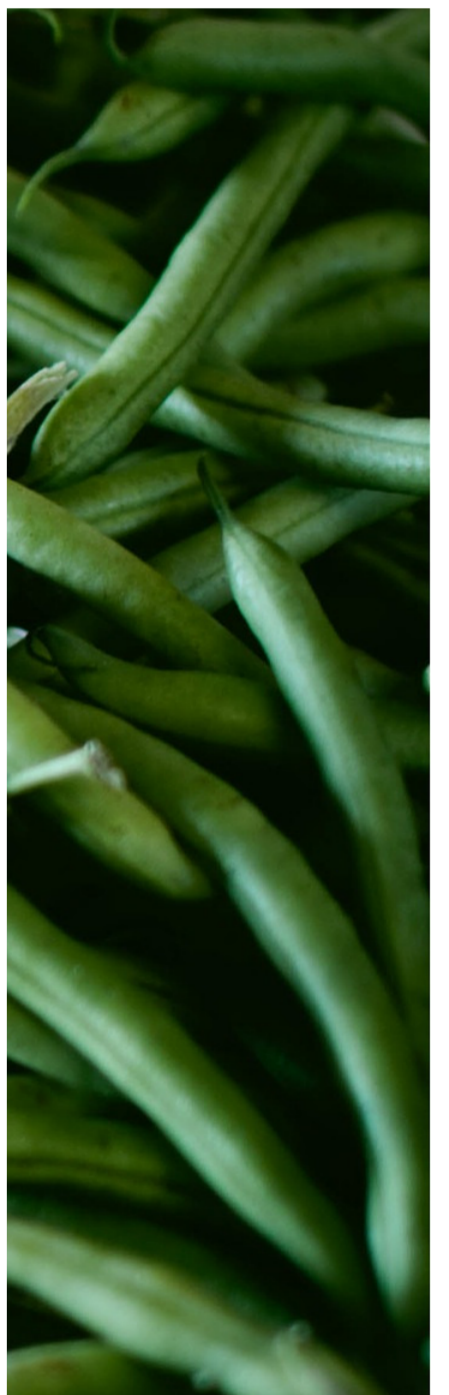
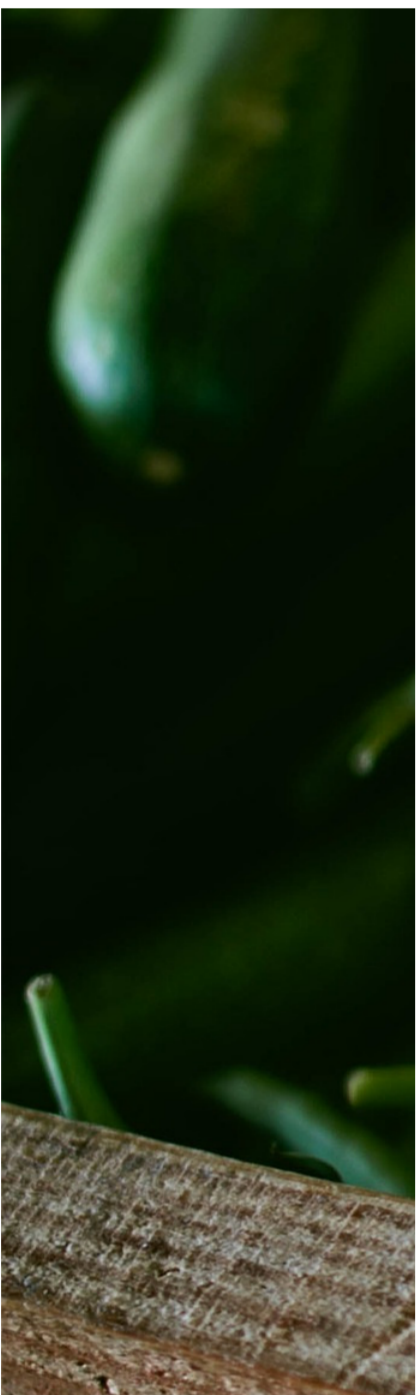
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WORCESTER POLYTECHNIC
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ELEVATED STOVES IN CERRITO, PARAGUAY

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WPI



**fundación
paraguaya**

An Interactive Qualifying Project
Submitted to the Faculty of
Worcester Polytechnic Institute, Worcester, MA

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Submitted to:

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Elevated Stoves in Cerrito, Paraguay

Executive Summary

Background: Currently, many families from the Qom communities of Cerrito, Paraguay, live in extreme poverty. They do not have access to simple amenities such as safe stoves. Many families cook over open fires on the ground, without elevation or ventilation. These conditions lead to several dangers and harmful side effects.

Objective: To collaborate with Qom families in enabling them to choose an adequate stove model for their families.

Deliverables:

- A pamphlet that details the different stove models currently available and where to obtain them
- A cost analysis describing the costs associated with each type of stove
- Experience gained by Arovia volunteers

Methods: The initial collection of information was done through research conducted prior to arrival in Paraguay. While in Paraguay, more information was found by visiting several of the communities. The visits included interviews with community members and observations of how the families cooked. In addition, information was collected by visiting local appliance stores to collect the prices and view characteristics of various stove models. Once that information was collected, a demonstration was held to show different stove options to community members, and how to operate them. After the event, a pamphlet was prepared describing the advantages and disadvantages of four types of stoves, and a comparative analysis of costs between them. The pamphlet was distributed to Fundación Paraguaya and to families interested in purchasing an elevated stove. The pamphlets were distributed to the following members of the communities: Mr. Catalino Coleman (Rio Verde), Mr. Tito Recalde (Rosarino), Ms. Ana Julia Escobar (Florecitas), Ms. Nancy Escobar (Florecitas), Ms. Silvia García and her mother (Rosarino).

Results: One of the most important results of this project is a reproducible pamphlet that helps families compare the cost-benefit analysis of several stove options, which can be useful for the Poverty Stoplight program as it guides families to move from "red" to "green" in the "elevated stove" indicator. On April 5, 2018, a demonstration was held to help the members of the community become familiar with different types of stoves, and compare their characteristics. Through their participation in this event, two volunteers from the Arovia program, Mary Aguilar and Sani Capli, gained experience in planning an informative demonstration about stoves. Finally, the project team sparked a conversation within the community to raise awareness about the importance of having an elevated stove in each home. This both strengthened and deepened communication between the Poverty Stoplight team and multiple Qom families and leaders.

Recommendations:

1.) We recommend that Fundación Paraguaya continue working with the Qom communities to improve their access to elevated and ventilated stoves. More specifically, the Foundation should make an effort to offer a greater variety of stove options for interested families. One example is the Tokyo TOKS150 sold through Electroban. This set costs 178.000 Gs. and includes an induction stovetop and one induction compatible pot, making this option perhaps a better fit for members of the Qom community.

2.) Additionally, the pamphlet prepared by the project team should continue to be distributed to interested members of the Qom community in Cerrito. The pamphlet must be updated and modified for use in other communities.

3.) We suggest that Arovia volunteers continue to work with the families whom they worked with during the project to guide them throughout the process of acquiring an elevated and ventilated stove.

This initiative will help the goal of the Fundación Paraguaya to eliminate poverty in Cerrito. By showing indigenous families, many of whom have indicated high levels of poverty, a better way to cook and by increasing ability in local volunteers, there will be a reduction in the inefficient, unhealthy, and dangerous mode of cooking that currently exists.

Cocinas Elevadas en Cerrito, Paraguay

Resumen Ejecutivo

Antecedentes: Actualmente, muchas familias de las comunidades Qom de Cerrito, Paraguay, viven en la pobreza extrema. No tienen acceso a simples comodidades como cocinas seguras. Muchas familias cocinan sobre el suelo, sobre fuegos, sin elevación o ventilación. Estas condiciones conducen a varios peligros y efectos secundarios dañosos.

Objetivo del Proyecto: Colaborar con las familias Qom para que puedan elegir un modelo de cocina adecuado para sus familias.

Entregables:

- Un folleto que detalla los diferentes modelos de cocinas actualmente disponibles en el mercado y dónde obtenerlos
- Un análisis de costos que describe los costos asociados con cada tipo de cocina
- La experiencia adquirida por los voluntarios de Arovia

Metodología: La recolección inicial de información se realizó a través de investigaciones realizadas antes de llegar a Paraguay. Ya estando en Paraguay se encontró más información visitando a varias de las comunidades. Las visitas incluyeron entrevistas con miembros de la comunidad y observaciones de cómo las familias cocinaban. Además, se recopiló información adicional al visitar tiendas locales de electrodomésticos para interiorizarse de precios y características de varios modelos de cocinas. Una vez que se recopiló dicha información, se realizó una demostración para mostrar diferentes opciones de cocinas a miembros de la comunidad, y cómo operarlas. Después del evento, se elaboró un folleto que describe las ventajas y desventajas de cuatro tipos de cocina, y un análisis comparativo de costos entre ellas. El folleto se distribuyó a la Fundación Paraguaya y a las familias interesadas en adquirir una cocina elevada. Los folletos fueron distribuidos a los siguientes miembros de las comunidades: Sr. Catalino Coleman (Rio Verde), Don Tito Recalde (Rosarino), Dona Ana Julia Escobar, Sra. Nancy Escobar (Florecitas), Sra. Silvia García and su madre (Rosarino).

Resultados: Uno de los resultados más importantes de este proyecto es un folleto reproducible que ayuda a familias comparar el “costo-beneficio” de varias opciones de cocinas, el cual puede ser de utilidad para el programa Semáforo de Pobreza a medida que guíe a familias a mover de “rojo” a “verde” en el indicador “cocina elevada”. El 5 de Abril de 2018 se realizó una demostración para ayudar a los miembros de la comunidad a familiarizarse con diferentes tipos de cocinas, y comparar sus características. A través de su participación en dicho evento, dos voluntarios de Arovia, Mary Aguilar y Sani Capli, adquirieron experiencia en la planificación de una demostración informativa sobre cocinas. Finalmente, se instaló una “conversación” en la comunidad (concientización) sobre la importancia de tener una cocina elevada en cada hogar, y se profundizó y se estrechó la comunicación entre el equipo del Semáforo de Pobreza y múltiples familias y líderes Qom entorno al tema.

Recomendaciones:

1.) Recomendamos que Fundación Paraguaya continúe trabajando con las comunidades Qom para mejorar su acceso a cocinas elevadas y ventiladas. Más específicamente, la Fundación debe hacer un esfuerzo para ofrecer una mayor variedad de cocinas para las familias interesadas. Un ejemplo es el Tokio TOKS150 vendido a través de Electroban. Este conjunto cuesta 178,000 Gs. e incluye una cocina y olla de inducción. Esta es una mejor opción para los miembros de la comunidad Qom.

2.) El folleto preparado por el equipo debe continuar siendo distribuido a los miembros interesados de la comunidad Qom en Cerrito. El folleto debe ser actualizado y modificado para su uso en otras comunidades.

3.) Sugerimos que los voluntarios de Arovia continúen trabajando con las familias con quienes trabajaron durante el proyecto para guiarlos a lo largo del proceso de adquisición de una estufa elevada y ventilada. El equipo considerará el trabajo completado cuando las familias pasen de "rojo" a "verde" en el indicador de cocinas elevadas del Semáforo de pobreza.

Esta iniciativa ayudará al objetivo de la Fundación Paraguaya de eliminar la pobreza en Cerrito. Al mostrarles a las familias indígenas, muchas de las cuales han indicado altos niveles de pobreza, una mejor manera de cocinar y al aumentar la capacidad de los voluntarios locales, habrá una reducción en el modo de cocinar ineficiente, insalubre y peligroso que existe actualmente.

Abstract

Many Qom families in Cerrito, Paraguay cook on unelevated stoves with open fires, resulting in issues such as burns and smoke inhalation. The project team worked to collaborate with Qom families in enabling them to choose an adequate stove model for their families. The team formed a working relationship with the Fundación Paraguaya, Arovia volunteers, and Qom community members. Interviews with Qom community members were conducted, a stove demonstration was held, and a cost analysis was done. With this information, a pamphlet of stove comparisons was created and distributed. Additionally, Arovia volunteers gained experience in addressing families who do not have an adequate cooking method. This project will be continued by the Fundación Paraguaya and Arovia volunteers.

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1.0 Introduction

Paraguay is a small country located in the center of South America. It spans from the northern border of Argentina to the southern edge of Bolivia. Like many of its surrounding neighbors, it suffers from many economic problems. One of these is the country's struggle with wealth inequality. Wealth inequality shows up in various ways: urban vs. rural, uneducated vs. educated, and indigenous vs. non-indigenous. The Qom are an indigenous group which live with these disadvantaged conditions in a rural town called Cerrito.

The Qom face hardships such as overcrowded homes, lack of employment, poor educational services, and even unsafe cooking conditions. Fundación Paraguaya, an organization dedicated to combating such issues, fights poverty within communities such as these. It has chosen to eliminate poverty within the Cerrito Qom communities to test its poverty elimination methods. One step to accomplish this goal is to replace cooking structures and appliances that cause social and health concerns within homes.

Stoves in these Qom communities areas use methods with a “high risk of health complications” (Bruce, 2014). Examples include unventilated stoves and open fires. These can emit toxic gases and smoke and increase the risk of burns. Rifkin et al verifies "exposure to wood burning and wood stove cooking (fogón) has been linked to a variety of cancers" (Rifkin et al, 2015).

To address these negatives, stove options were presented to interested families. A prominent solution included stove modification or substitution. The project worked with Qom families to help them choose what might be best for them.

2.0 Background

This section introduces Benjamin Aceval, the township in which the Qom reside, characteristics of the Qom community, current cooking equipment and methods and the problems these generate.

The Gran Chaco is a region of lowland planes that account for 60% of land territory but only 2% of the overall population (CIA, 2018). Within the Gran Chaco is a rural city, Benjamín Aceval, that consists of mainly farmland. In fact, “Benjamín Aceval has the most agricultural activity and livestock in the department of President Hayes” (Zylich, 2017). A variety ethnic groups live within Benjamín Aceval. The Qom, an indigenous people, are one of these. They are among Paraguay’s poorest, and even in Benjamin Aceval have lower living standards than most other people. One result of this lower living standard is more unhealthy and dangerous cooking methods. The Qom typically cook on open fires on the ground causing safety hazards for both operators and their children where smoke inhalation and contact with flame are a given.

These dangers have been explored extensively in research literature. Studies show, unventilated cooking methods dependent on open-flame cooking have carbon dioxide concentrations ten times greater than chimney stoves (Smith, 2015). Diseases caused by burning solid fuels include pneumonia, chronic obstructive pulmonary disease, and heart disease. "Other consequences include vision impairment, low infant birth weight, and burns and other injuries, especially among children" (Goetz, 2011).

3.0 Methodology

This section describes the research, working relationships, data gathering, and data analysis that was necessary to improve efficiency and safety of stoves in the Qom community.

3.1 Preliminary Research

Prior to arriving in Paraguay, research showed that among families who use traditional cooking methods, "many Paraguayans wanted a fogon as their cooking appliance" (Bruce, 2014). On-the-ground research showed, in contrast, that families want more modern forms of cooking.

3.2 Working Relationships

3.2.1 Fundación Paraguaya

The team first established working relationships with senior members of Fundación Paraguaya who are assigned to work with Qom communities in Cerrito. These members: Celsa Acosta, Fernando Pfannl, and Dorothy Wolf described the sociology of these communities and emphasized the importance of ownership for community improvement.

The Fundación Paraguaya's Poverty Stoplight program distributes self assessments within these communities. These assessments use a 3 color scale of red, yellow, and green to determine poverty status among different indicators. One of these indicators is elevated

stoves. The details of this indicator can be seen in Appendix E. The foundation had specific information on which families identified elevated stoves as a priority.

Senior members used Poverty Stoplight data to determine which families to contact. Additionally, these senior members helped plan visits to the neighborhoods and ensured cultural etiquette.

3.2.2 Arovia Volunteers

The team also worked closely with Paraguayan volunteers from the Arovia program, a group of young professionals work to reduce poverty and support social development. In this role, the volunteers were able to support the Poverty Stoplight initiative in the area of unelevated stoves. Specifically, they facilitated communication between the project group and members of local communities. They were especially helpful in the translation between Qom and Guarani - native languages- and Spanish. They assisted with interviews and helped explain information about different stoves.

3.2.3 Qom

With the Arovia volunteers, the team embarked on initial visits to Qom communities. The visits established relationships with family members and community leaders. These relationships were critical to the interviews which followed.



Figure 1: Rio Verde community leader and team in a well furnished Qom school!

3.3 Data Gathering

3.3.1 Interviews

Interviews sought information about families' daily activities and cooking habits. Semi-structured principles guided the interviews (Adams, 2015). The interview script can be seen in Appendix B. Only participants who expressed interest in elevated stoves were interviewed. Information gathered includes current cooking methods, preferred cooking methods, number of people in each home, and typical recipes. The responses helped the team select stoves that best fit each family.

3.3.2 Wilbur Diagram

The team kept a Wilbur Diagram in mind while they gathered data, and later considered how responses align with the four quadrants: intentional, behavioral, cultural, and social systems. This analysis helped identify the most effective solutions. For example, a family in the Rosarino community includes a daughter who has an electric stove and a mother

who uses a fire pit. Though wood is difficult to find, the mother clings to her wood-gathering tradition. This is an example of behavioral and cultural resistance.

<p>Intentional: Example: Personal preference of cooking</p>	<p>Behavior: Example: Prior cooking appliance experiences / knowledge of different techniques</p>
<p>Culture: Example: How the family is impacted by a stove substitution or modification</p>	<p>Social Systems: Example: Paraguayan law, Convention C169</p>

Figure 2: Wilbur Diagram

3.3.3 Stove Demonstration

One of the best ways to introduce people to new equipment and methods is through a hands-on demonstration. On April 5, 2018, a stove demonstration was held for members of the Qom community. The team went house to house to invite people to attend. The demonstration focused on different types of stoves and their effect on the taste of meals. The types of stoves included an induction stove, an electric stove, a rocket stove with wood, and brazier with charcoal. By cooking the same Guiso meal on each stove, participants could compare the taste. The community members had the opportunity to operate each device and learn about the positives and negatives of each kind of stove. Additionally, the Arovia volunteers, Mary and Sani, helped orchestrate the event.

3.3.4 Costs around Paraguay

After the demonstration, the next steps were to find different stoves and record costs around Villa Hayes and Asunción. For the rocket stove, a construction materials store in Villa Hayes was contacted for prices of bricks and mortar. Costs of a brazier and coal were obtained from Vago, a convenience store in Cerrito. The prices of charcoal that Qom community members typically buy from a traveling salesman was also recorded. The team visited Tupi in Asunción to find prices of induction and electric stoves in the city. In Villa Hayes, the team went to Alex S.A. and Inverfin to find stoves closer to the Qom communities. Online inventory was also recorded such as Electroban and Superseis. The prices of the stoves and materials can be found in Appendix D. This information was used to create a cost analysis of the stove options.

3.4 Data Analysis

After information was collected, it was organized and interpreted. Interviews were summarized and sorted. Stove options were examined through a Strengths, Weaknesses, Opportunities, and Threats diagram (SWOT), as shown in Figure 3. Additionally, a cost analysis of the stoves was completed and considered. The cost analysis is displayed in Tables 3 and 4.

3.4.1 Interviews

Each interview was summarized. With these summaries, the team created a table of cooking profiles. These profiles can be found in Table 1.

3.4.2 Examination of Stove Options

3.4.2.1 Strengths, Weaknesses, Opportunities, and Threats Diagram (SWOT)

One method to compare stove types is a SWOT Diagram (Humphrey, 1974). The diagram requires two things: a list of the products or services that will be analyzed, and their accompanying traits. In the case of the four stoves under consideration, these traits include energy efficiency, initial and long-term cost, durability, cook time, convenience, and safety. Once traits are identified, they can be assigned to different quadrants of the SWOT diagram. Where the traits appear as weaknesses and threats, they can be examined to see if solutions are available. An unexpected outcome of this analysis was that broken induction stoves can be repaired. Furthermore, comparative shopping showed that induction stoves can be purchased for much less than earlier estimates and include induction compatible cookware.

<p>Strengths</p> <p>Induction: Energy efficient, safest, cooks quickly</p> <p>Electric: Durable, less expensive initial cost</p> <p>Brazier: Cheap initial cost</p> <p>Rocket stove: Cheap initial cost</p>	<p>Weaknesses</p> <p>Induction: High initial cost, requires special pots</p> <p>Electric: Slower to heat up, less energy efficient</p> <p>Brazier: Unsafe, takes a long time to start</p> <p>Rocket stove: Unsafe, takes a long time to start, wood is inconvenient</p>
<p>Opportunities</p> <p>Induction: Lowest long term cost</p> <p>Electric: Can use with any pot or pan</p> <p>Brazier: Can be fueled by wood or charcoal</p> <p>Rocket stove: Personalizable</p>	<p>Threats</p> <p>Induction: Low durability</p> <p>Electric: Burns</p> <p>Brazier: Burns, unsafe, fuel costs</p> <p>Rocket stove: Burns, unsafe</p>

Figure 3: S.W.O.T Analysis of Stove Options

3.4.2.2 Cost Analysis

The cost analysis examined cooking information available in towns near Cerrito. The prices for stovetops were obtained from store samples and online retailers. Energy prices were derived directly from the monthly utility bills of community members. The power use comes from information posted on labels attached to appliance store units. The price of repair finds its source in conversations with local repairmen and by asking for pricing of the most common repairs done on induction stoves. The number of hours it takes to cook a meal was determined by recording how long the participants cooked meals during a stove demonstration held at the Escuela Agrícola San Francisco. This information was used to create a cost analysis. The analysis compares the cost of having and using each of the four types of stoves. The final comparison showed that, contrary to the team’s initial perception, having an induction stove ends up being the cheapest option when compared over time.

3.5 Ethics

All research and project solutions were conducted ethically according to WPI and UNESCO's policies. The following section outlines important ethical factors relating to the project.

3.5.1 Consent of the Qom

Verbal consent was obtained from interested families prior to interviews. At the beginning of each interview, the team asked participants for permission to use their names and/or photographs. Information was only used for research purposes.

3.5.2 Convention C169: Indigenous and Tribal Peoples Convention

Convention C169 (ILO, 1989) applies to tribal peoples as well as indigenous populations. The convention serves to ensure legal rights, provide fundamental freedoms, and guard the property and culture of those it applies to. With respect to the Qom people, the articles of this convention were followed to ensure their rights were not infringed upon.

3.5.3 Safe Interaction

All federal, state, and local laws on protection of human subjects in research were followed.

4.0 Results & Discussion

The project generated many results. These include solid working relationships with several Qom communities, cooking profiles of interviewed community members, data from the team's stove demonstration about cooking times and taste preferences between meals cooked on different stoves, information about repair options for induction stoves, and three main deliverables: a cost analysis, an information pamphlet, and experience for Arovia volunteers who worked with the elevated stoves indicator.

4.1 Working Relationships with Participating Qom Communities

The team was first taken to communities by Arovia volunteers and made introductions with community leaders. Introductions led to a working relationship with Qom leaders and interested community members. These relationships aided the interview process.

4.2 Cooking Profiles for Community Members

From interviews, the team collected information about cooking in the communities. Cooking profiles for each family were made using their interview responses. These profiles consisted of the number of people the family cooks for, current type of fuel used, desired type of fuel to use, current cooking method, and desired cooking method.

	Family #1	Family #2	Family #3	Family #4	Family #5
Community	Florencias	Rosarinos	Rosarinos	Rio Verde	Rio Verde
# of people	12	1	5	8	7
Fuel (current)	Charcoal	Wood	Electricity	Wood	Wood
Fuel (preferred)	Charcoal	Wood	Electricity	Electricity	Wood
Stove (current)	Brazier	Fire Pit	Electric Stove	Hanging Pot	Fire Pit
Stove (preferred)	Induction Stove	Rocket Stove	Electric Stove	Electric Stove	Wood Stove

Table 1: Cooking Profiles of Community Members from Interviews

4.3 Stove Demonstration Results

Information obtained from the stove demonstration includes time to start the cooking apparatus, time to cook the meal, form of energy, taste preference between meals cooked on different stoves, and cost of each stove. These results appear in Table 2. The taste test yielded that the majority preferred guiso cooked on the induction stove. The guiso was prepared by the two Qom women who participated. Seven people in all tasted the guiso and voted their preference. The two Qom women were among those who preferred the induction cooked meal.

Stove Type:	Induction	Brazier	Electric	Rocket
Time to Start	A couple seconds	~ 15 minutes	A couple seconds	~ 40 minutes
Time to Cook	20 minutes	~ 1 hr 30 minutes	1 hr	~ 1 hr 30 minutes
Form of Energy	Electricity	Charcoal	Electricity	Charcoal
Taste Test Results	1st	3rd	4th	2nd
Cost	400.000 Gs (with pot)	25.000 Gs	250.000 Gs	50.000 Gs

Table 2: Results of Cooking Guiso on Four Stoves

In addition to a tasty meal, the participants acquired practical skills in using each cooking device. They saw first-hand how long each cooking device took to start and cook, how intuitive the device is, and any problems that arose. It was clear that the charcoal and wood fuels took a long time to start up. Similarly, the electric stove heated much slower than the induction stove. Overall, when all factors are taken into account, the induction stove appears to be the best.

4.4 Available Repair Options for Induction Stoves

Induction stoves can be repaired. This is contrary to a prevailing belief that induction stoves must be replaced annually. The team found service shops that can repair induction stoves near the Qom communities in Cerrito.

4.5 Deliverables

There are three deliverables from this project: a cost analysis, an information pamphlet, and experience gained by Arovia volunteers.

4.5.1 Cost Analysis

An essential component of the project was the cost analysis of each stove option. It was created to determine which of the four stoves (Induction, Brazier, Electric, and Rocket) would be the most economically viable option. The data in Table 3 was used to calculate the operating costs for each type of stove.

Induction		Electric	
Hours per meal	0.5	Hours per meal	1
Power Use (watts)	1500	Power Use (watts)	1500
Price (kWh) (gs)	350	Price (kWh) (gs)	350
Price of Stovetop	200.000	Price of Stovetop	127.500
Price of repair	100.000	Price Repair	100.000
Brazier (Charcoal)		Rocket Stove (Wood)	
Price (15 day)	30.000	Price Per Brick	800
Brazier Price	25.000	Price (15 days)	35.000
		Number of bricks	40

Table 3: Costs of Stoves Data

The operating costs for each type of stove were then used to calculate the cost of cooking an individual meal. Cooking prices over different periods of time were also calculated.

	Per Meal	Per Day	Per Month	Per Year	Total Cost (Per Year + Device)	Per 3 Years
Induction						
Price (Guaranies)	262	787	23.618	283.411	483.411	1,250,232.70
Price (Dollars)	\$ 0.05	\$ 0.14	\$ 4.29	\$ 51.53	\$ 87.89	\$ 227.32
Brazier					Total Cost (Per Year + Device)	Per 3 Years
Price (Guaranies)	667	2.000	60.000	720.000	745.000	2,185,000.00
Price (Dollars)	\$ 0.12	\$ 0.36	\$ 10.91	\$ 130.91	\$ 135.45	\$ 397.27
Electric					Total Cost (Per Year + Device)	Per 3 Years

					Device)	
Price (Guaranies)	524	1.575	47.235	566.822	694.322	2,027,965.40
Price (Dollars)	\$ 0.10	\$ 0.29	\$ 8.59	\$ 103.06	\$ 126.24	\$ 368.72
					Total Cost (Per Year + Device)	
Rocket	Per Meal	Per Day	Per Month	Per Year		Per 3 years
Price (Guaranies)	667	2.000	60.000	720.000	752.000	2,192,000.00
Price (Dollars)	\$ 0.12	\$ 0.36	\$ 10.91	\$ 130.91	\$ 136.73	\$ 398.55

Table 4: Cost of Stoves Analysis

4.5.2 Information Pamphlet

The second deliverable of this project was a tri-fold pamphlet that serves as a guide for families to choose an adequate stove based on their individual needs. It provides comparisons of each type of stove based on cost and operational characteristics. This guide was made for distribution to Poverty Stoplight participants, so they may make an informed decision about which stove to purchase.

The stove options are presented alongside two pros and cons, a price range, and local stores where they can be purchased. The yearly cost of each stove is displayed in the form of a bar graph, to visually indicate the difference in long-term costs. This cost is based on an analysis that includes both the price of purchase and operation. The operation calculation is based on the time taken to cook guiso, a traditional dish, for each meal three times a day. There is a design comparison table that lists the factors indicated to be important by participating families. These factors are: cooking time, energy efficiency, price of apparatus,

durability, price of operation, and safety. The stove received a check if it ranked highly in each category and an x if it did not.

The pamphlet also provides a final assessment of the data analysis. The team recommends that the induction stove is the most advantageous option due to its low long-term cost, high safety rating, and ease of operation. Finally, the guide lists local services for reparation of stoves. Copies of the pamphlet were delivered and explained to six Qom families during this project.



Figure 4: Pamphlet Page 1



Figure 5: Pamphlet Page 2

4.5.2.1 Pamphlet Distribution

Using the collected and analyzed data, an informative pamphlet was formulated and hand-delivered to five of the families that the team worked with. The Fundación Paraguaya volunteers assisted in communicating the purpose and content of the pamphlet. Participants were able to keep the pamphlet for reference to aid in their decision of which stove to purchase. The pamphlet will continue to be circulated by the Fundación Paraguaya throughout communities in Cerrito. The content will also be utilized by the Poverty Stoplight to inform communities across Paraguay of the advantages and disadvantages of each stove type. This contribution allows families to make an informed decision they convert to a stove that meets the Poverty Stoplight guidelines.

4.5.3 Experience Gained by Arovia Volunteers

Two Arovia volunteers, Mary and Sani, worked with the elevated stove indicator alongside the team. They gained experience with semi-structured interviews, the organization of interactive events, and distribution of information. Through their work with the team, the Arovia volunteers gained the necessary experience to continue the project.

5.0 Conclusion

The Fundación Paraguaya currently promotes an induction stove kit which includes a stove top and three pots to families participating in its programs. After interviewing families in Cerrito, it was found that this option is not a good fit. A simpler kit is more appropriate. The new kit has only one pot and an induction stove top. This proposal follows the Poverty Stoplight principle that the intervention meets the individual needs of the community.

6.0 Recommendation

These recommendations will help contribute to decrease poverty in Cerrito, and increase the number of elevated stoves.

First, the Fundación Paraguaya should make an effort to offer a greater variety of stove options for interested families. One example is the Tokyo TOKS150 sold through Electroban. This stove costs 178.000 Gs and comes with an induction stovetop and one induction compatible pot, making this option perhaps a better fit for the Qom community.

Additionally, the pamphlet prepared by the project team should continue to be delivered to interested members of the community. The pamphlet must be updated and modified for use in other communities.

We suggest that Arovia volunteers continue to work with the families with whom they worked during the project to continue guiding them throughout the process of acquiring a raised and ventilated stove.

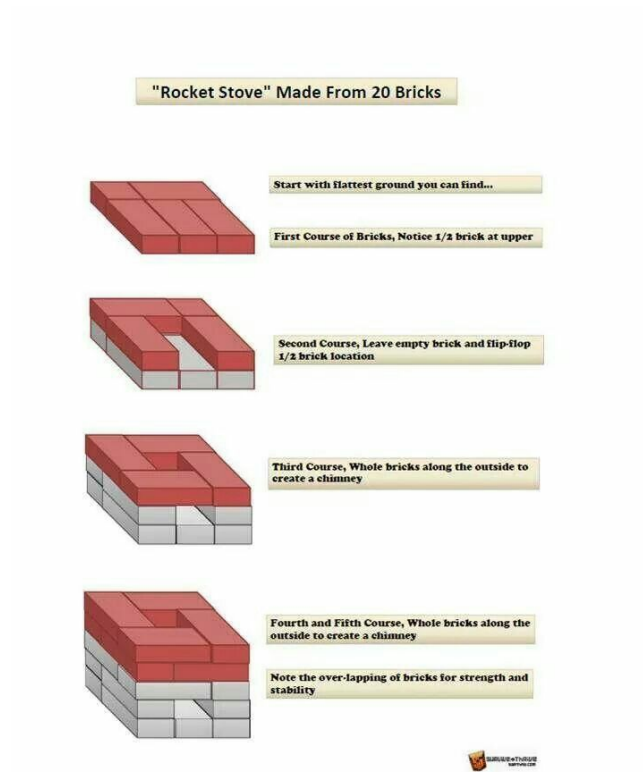
This initiative will help the goal of the Fundación Paraguaya to eliminate poverty in Cerrito. By showing indigenous families, many of whom have indicated high levels of poverty, a better way to cook and by increasing ability in local volunteer, there will be a reduction in the inefficient, unhealthy, and dangerous mode of cooking that currently exists.

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8.0 Appendices

Appendix A: Rocket Stove Construction



This construction manual explains how the team made a rocket stove to use for the stove demonstration.

Appendix B: Interview Questions

1. Hola, como esta? Nos puede ayudar a mis amigos y a mi? Queremos saber un poco más sobre las cocinas¹ en su vecindario.

Hi, how are you? Do you mind helping my friends and I? We want to find out a little more about stoves in your neighborhood.

2. Le podemos hacer unas preguntas? No es necesario recordar su nombre con las respuestas a menos que quiera.

We would like to ask you some questions. We don't need to use your name, unless you want us to.

3. Estás interesado en una cocina nueva?

Are you interested in a new stove?

4. Comos estas cocinando ahora?

How do you cook now?

5. Porque quieres una cocina elevada?

Why do you want an elevated stove?

6. Que tan grande es tu familia? Cuántos hijos tiene?

How big is your family? How many children do you have?

7. Cuáles son tus comidas preferidas y las de tu familia?

What are you and your family's favorite foods?

¹ "Cocina" is used in place of "estufa" stove in Paraguay

8. Quién es el cocinero normalmente?

Who cooks normally?

9. Para cuántas personas cocina?

For how many people do you cook?

10. Cuánto tiempo se tarda cocinar una comida?

How long does it take to cook a meal?

11. Te prefieres usar electricidad, carbón, o leña para cocinar?

Do you prefer to use electricity, charcoal, or wood to cook?

12. Quieres su cocina afuera de la casa o en la casa?

Do you want your stove outside or inside of your house?

13. Que tienes la cocina de tus sueños?

What is the stove of your dreams?

14. Estás interesado/a en un cocina como cualquiera de estos?

Are you interested in a stove similar to any of these?





c.



d.



e.

Appendix C: Detailed Stove Options

Induction Stoves

Induction stoves work by inducing an electromagnetic field through a copper coil, which in turn, excite the electrons in the conductive utensil creating heat. This can be seen in Image 1 below:

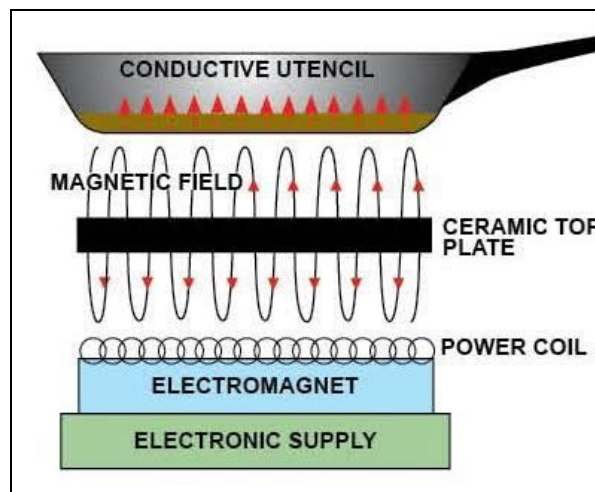


Image 1: Induction Stove Mechanism

(<https://www.quora.com/Can-I-use-iron-tawa-in-induction-to-make-dosa>)

This form of heating allows the pan to heat extremely quickly and efficiently. No energy in the form of heat is lost to the surroundings as the electromagnetic field is only able to heat the ferrous pan.

Electric Stoves

Electric stoves work by passing a current of electricity through a wire. This wire has a certain resistance to the flow of electrons and creates heat when any pass through it. A basic diagram of an electric burner can be seen below:

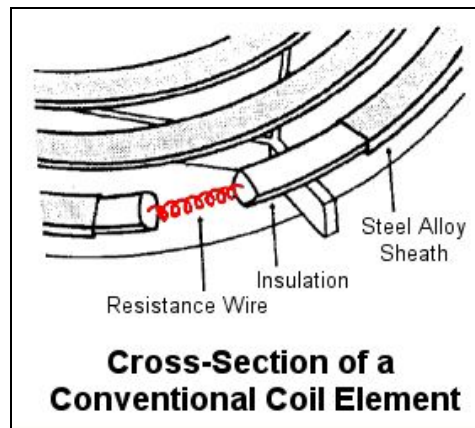


Figure..

(<https://www.quora.com/Whats-the-electrical-insulation-on-stove-top-heating-elements-made-out-of>)

Electric burners are relatively inexpensive, however They produce massive amounts of heat and are much more inefficient when compared to the induction burners. Electric stoves are also more dangerous when compared to the induction stove, the coils heat up everything around them including the surface that is used to cook, where as induction only heats up the cooking pot and not the surrounding area.

Elevated Brazier

The elevated brazier works with either coal or wood as a fuel source. The stove is made up of a hollow metal frame with legs. The frame is designed to allow for a pot to be put on top of an open flame. A model of a Brazier is shown below:



A Brazier is a simple and effective option to improve a kitchen. Both charcoal and wood can be used for fuel, and it has a low immediate cost. Additionally, it is bought as a product and requires no time to construct or prepare.

Rocket Stove

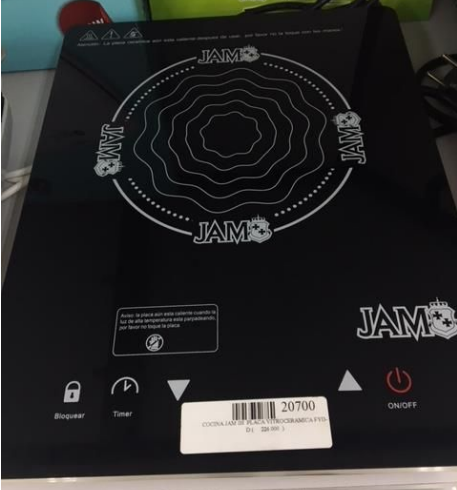
The rocket stove is a simple stove made from piling a couple of bricks together to form an elevated structure. The bricks in this stove have two functions: to elevate the fire off from the ground and to conceal the flame from the elements. A simple model of the rocket stove is shown below:



The rocket stove is able to use both wood and charcoal as fuel. Assembly time for the rocket stove is about 15-30 minutes depending on its size.

Appendix D: Stove Information From Stores in Asuncion and Villa Hayes

Tupi - Asuncion

Type (brand & stove type) & price	Photo
Jam Electric 224.000Gs	 A photograph of a black electric stove control panel. The panel features a large circular digital display in the center, surrounded by concentric circles. The brand name 'JAM' is printed in white on the panel. Below the display, there are several control buttons: a lock icon labeled 'Bloquear', a clock icon labeled 'Timer', a power icon labeled 'ON/OFF', and a small rectangular display showing the number '20700'. A barcode is visible on the panel, with the text 'COCENLAD S.R.L. EL ESTROBILABO S.R.L. S.1. 20197 3' printed below it.

JAM

Electric with 2 burners

840.000Gs



MIDAS

Induction

225.000Gs



IH

Induction

318.000Gs



Tokyo

Induction

304.000Gs



Tokyo

Induction

364.000Gs

Includes 1 pot



Severin

Electric - 2 burners

247.000Gs



Electroban (online) - Villa Hayes

Tokyo

Induction

178.000 Gs (If purchased with a credit card online)

255.000 Gs (In store)

Includes 1 pot



Tokyo

Induction

263.500 Gs (If purchased with a credit card online)

376.429 Gs (In store)

Includes 1 pot



Midas

Induction

259.250 Gs (If purchased with a credit card online)

370.357 Gs (In store)

Includes 1 pot



Midas

Induction

332.500 Gs (If purchased with a credit card online)

475.000 Gs (In store)

Includes 1 pot



Alex S.A - Villa Hayes

Electrostar

Electric

6 payments x 23.000Gs



Electrostar

Induction

6 payments x 69.000Gs



Inverfin - Villa Hayes

Fama

Electric

100.000Gs




Fama

Induction

200.000 Gs or 6 payments x 42.000 Gs



Superseis - Asuncion

<p>Dayo</p> <p>Induction</p> <p>180.000Gs</p> <p>Includes 1 Pot</p>	
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Ferreteria Moreno Materiales De Construcción, Villa Hayes

Material	Price (Guaranies)
Basic Brick	600/brick
Mortar	49.500
Heat Treatment	21.000
X-Large Brick	1.300/brick

Appendix E: Poverty Stoplight Definition for Elevated Stoves Indicator

Indicators 11 Remaining

La familia cuenta con un espacio cubierto, cocina elevada y ventilada, y principalmente no cocina con estiércol, carbón o leña.

La familia no cocina con estiércol, carbón o leña, pero cocina al aire libre y/o cocina en fogón o fogata (no cuenta con cocina elevada).

La familia cocina principalmente con estiércol, carbón o leña.

Back 13. Cuenta con cocina elevada y ventilada? This field is required

Family Record Economic Questions 3 Indicators 4 Life Map

To be green in elevated stoves, the family's stove must have its own space, it must be elevated and ventilated, and the main fuel cannot be wood or charcoal.

To be yellow in elevated stoves, the stove cannot use charcoal or wood, it can be outdoors, but it is not elevated.

To be red in elevated stoves, the family cooks with charcoal or wood as the main fuel.