Healthy Stoves in Rural and Urban Homes and Family Businesses in Nicaragua

Asociación Fénix Programme for Improved Stoves

Case Study

Nicaragua, 2015

ENERGIA
INTERNATIONAL NETWORK ON
GENDER AND SUSTAINABLE ENERGY

IUCN

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Preface

The International Network on Gender and Sustainable Energy (ENERGIA) and the International Union for the Conservation of Nature (IUCN) signed a collaboration agreement in 2008 to integrate the complex linkages between energy, gender and the environment. Implementation of the initiative entitled "Women as Leaders and Change Agents in the Energy Sector" began in 2013 in four countries of Central America, coordinated by the IUCN Global Gender Office, with support from ENERGIA. This initiative was made possible thanks to financial support from Hivos, the Humanist Institute for Development Cooperation.

The objectives included producing written and visual materials to capture and express the way in which gender can be mainstreamed within energy projects. This way, the initiative seeks to document and share experiences, lessons learned, best practices, and recommendations, as a way to support and build the capacity of decision-makers, project implementing organisations, grassroots groups, energy and sustainable development experts, and government representatives, increasing the number of energy projects with gender equality.

This document is the last in a series of four case studies that will be conducted in Central America under this initiative. "Healthy stoves in rural homes and family businesses in Nicaragua" shows the results in terms of gender equality obtained by Asociación Fénix, a Nicaraguan non-governmental and non-profit organisation established in 2001 that works to promote renewable energy sources and responsible use of natural resources to reduce climate change. This study describes the process of a program that began in 2012, to promote and install improved biomass stoves (IBS). At the same time, the study shares certain considerations on: (i) The need for community involvement in similar projects; (ii) women's economic empowerment and their opportunities to participate in non-traditional roles, and; (iii) positive health impacts for women, children, and older adults by substituting a traditional cook stove with an IBS.

1. Introduction

Asofenix is a Nicaraguan non-governmental organisation that was founded in 2001, with the objective of contributing to improve the living conditions of the rural population through the use of renewable energy sources and appropriate use of natural resources.

In consequence with this objective, Asofenix believes it is relevant and a priority to address the problems linked to the unsustainable consumption of forest energy resources in Nicaragua, such as firewood and charcoal.

In this sense, and in response to growing demand and shrinking replacement capacity for energy resources, the Improved Biomass Stove (IBS) program focuses on reducing use and consumption of firewood as household fuel. Asofenix fosters and facilitates access to models of safer and more efficient stoves that save firewood and reduce smoke emissions, for rural and urban use.

This program responds to the mission of Asofenix: To contribute to the promotion, development and innovation of renewable energy sources and sustainable production with environmentally-friendly techniques.

Implementation of this program is also linked to Guideline Four within the National Firewood and Charcoal Strategy (2011 – 2015), which proposes the objective of ***improving energy efficiency in the use of firewood and charcoal in all areas of the national economy, optimizing the final consumption of firewood in homes and industry.***

According to the 2005 census in Nicaragua, 62.0% of the population uses firewood or charcoal to cook, and this percentage of the population is constantly exposed to dangerous smoke emissions (National Institute of Development Information, 2005).

The stove program promoted by Asofenix has been implemented on a national scale, and it emphasizes improvements for the health and quality of life of the population served. The achievements of the project have demonstrated that the changes are effective and contribute to family wellbeing. Thus far, different models of improved stoves have been built and installed in 14 rural communities located in the Western, Central, Northern, and Caribbean regions of the country (Autonomous Northern Caribbean Region, RACN; this ecological region is highly vulnerable due to its climate conditions and demographic pressures).

This case study presents Asofenix's experience and working methodology to try to ensure program sustainability. Key elements include the promotion and adoption of technology, ensuring an accessible financing system, and building local capacities to facilitate IBS management.

The strategy used by Asofenix starting in 2012 has allowed 258 families to replace traditional cook stoves with IBS, improving their quality of life and the environment around their homes.

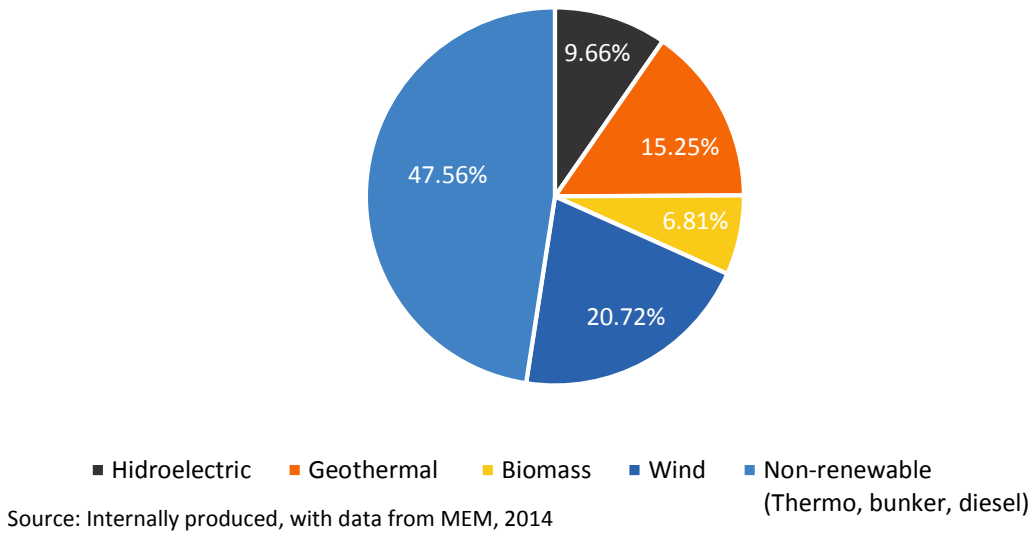
2. Background and Geographic Context

Socioeconomic development in a country is intrinsically linked to a stable supply and efficient use of energy resources. Nicaragua, however, with an estimated population of 5.8 million, has the lowest electrification rate in Central America (73.7% in 2012, according to data from the Ministry of Energy and Mines, MEM). This rate is well below the average electrification for Central America, which hovers around 85.8%.

In Nicaragua, 52.44% of the national energy grid comes from renewable sources. The MEM has projected a goal for the year 2020 of reaching 90% overall electrification, with 90% of the energy coming from renewable sources.

The main sources of high-potential renewable energy include: geothermal power (2,000 MW), hydroelectric power (1,500 MW) and wind (600 MW). As a tropical country, Nicaragua also has high potential for solar energy which the country is beginning to use.

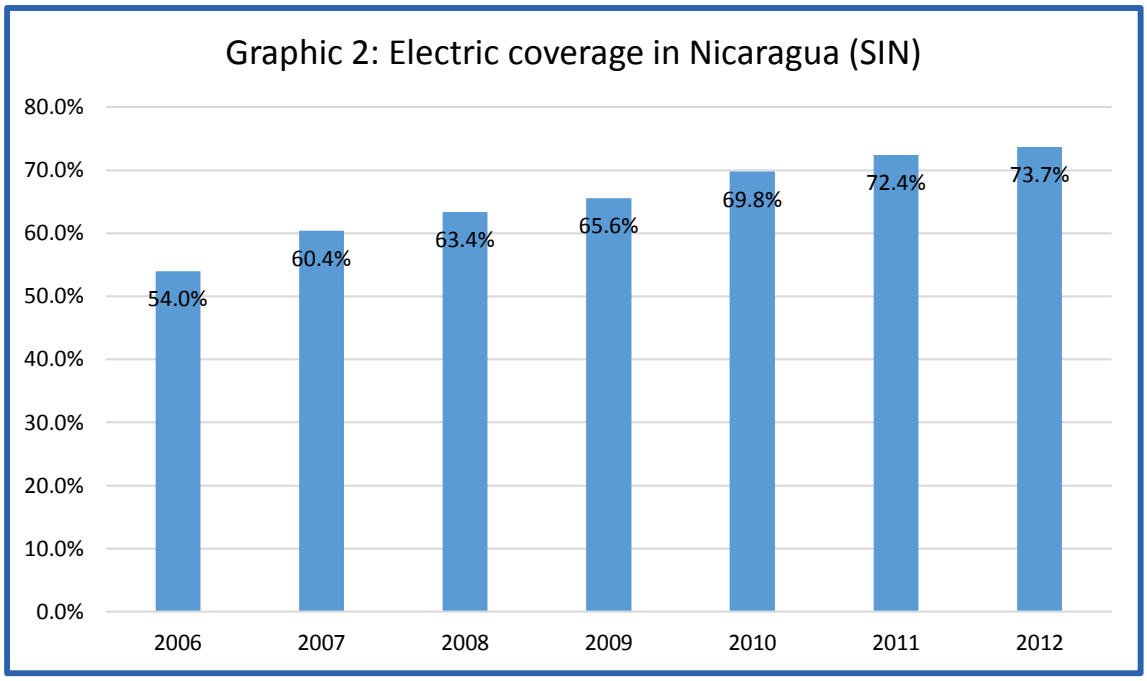
Graphic 1: Composition of the Energy Grid in Nicaragua



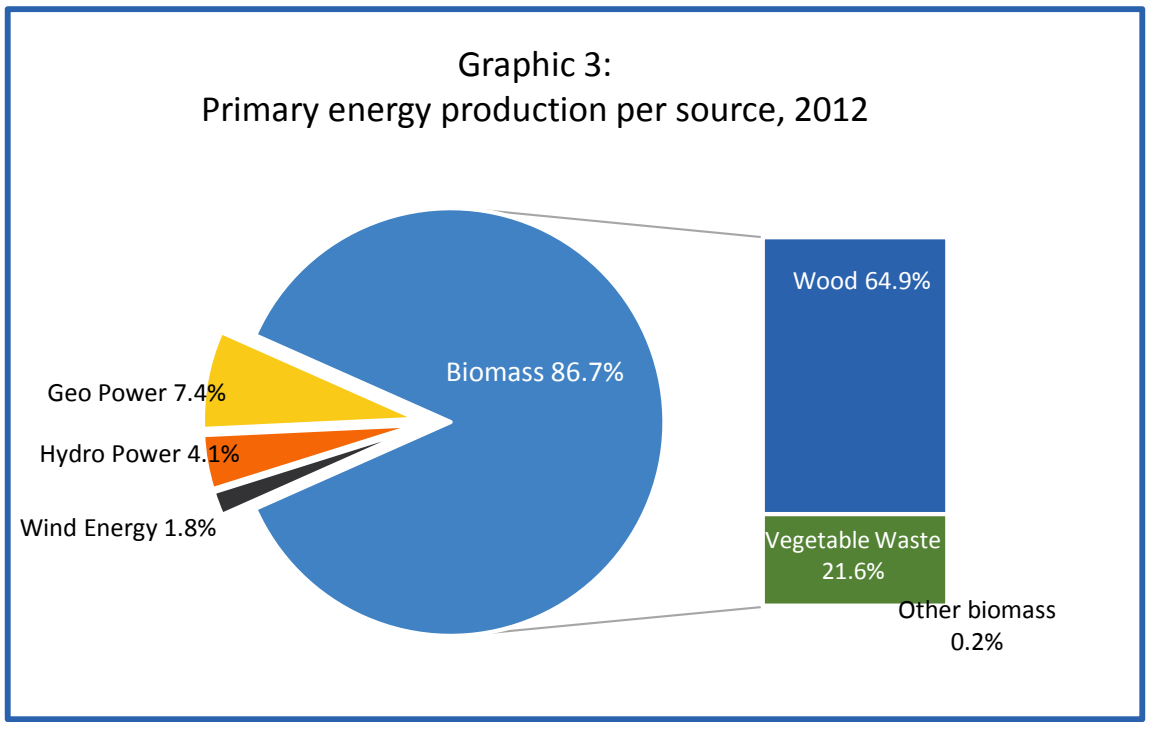
Source: Internally produced, with data from MEM, 2014

Electricity coverage has increased in recent years, as detailed in graphic 2. But over 1.5 million inhabitants, in their great majority residents in rural areas, still do not have access to electricity in their homes or depend on firewood, which is inefficient and harmful to their health.

According to the National Energy Balance for 2012 produced by MEM, firewood is the main source of energy in the Nicaraguan energy matrix, accounting for 64.9% of primary energy production.

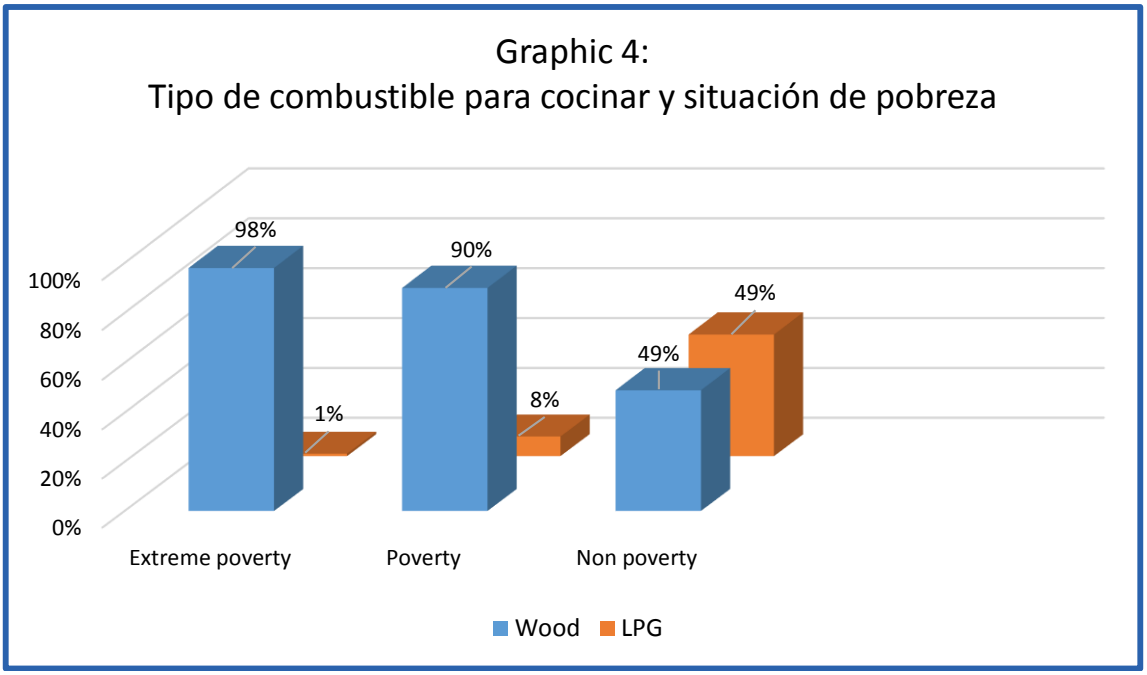


Source: (MEM, 2012b) Indicator for overall electric coverage from 2006 to 2012



Data from the 2005 census show that in the rural areas, over 95% of poor households use firewood for food preparation. This means that approximately 3.2 million people do not have access to efficient cooking technologies and use open fires, posing a public health problem. The risk of children with low birth weight or damages in cognitive capacities, in the case of newborns, or of acquiring chronic respiratory illnesses in the case of women, children under the age of five, and older adults—the most exposed social groups—is very high and may even be a cause of death (National Institute for Development Information, 2005).

The results of the last national survey on firewood performed in 2007 by the MEM show that 1.8 million people (nearly 350,000 households) use firewood as their main fuel source (MEM, 2011b). The quantity of firewood consumed is estimated between 1.5 and 1.8 million metric tonnes, as this energy source is an excellent alternative for the poor population, who simply collect or purchase the amount they need each day for food preparation.



The World Health Organisation, in their publication "Household Energy and Health, Fuel for a Better Life" (2007), estimates that pollution inside homes as a result of the inefficient use of biomass for cooking, could cause up to 1.5 million premature deaths per year around the world through the year 2030; this number is greater than the estimates for malaria, tuberculosis, and HIV. The most affected age group are children, who account for 10% of the deaths.

In field visits in the communities in Central Nicaragua, Asofenix has identified numerous cases in which women, especially older women, have been diagnosed with respiratory diseases. The doctors treating some of these patients have even prescribed replacing their traditional cook stoves with more efficient models (improved stoves). The cause of these illnesses is the constant exposure to smoke and high heat from the open fires from an early age.

Another problem is the pressure exerted upon increasingly scarce timber resources, which contributes to the reduction in national forest coverage in Nicaragua, where the deforestation rate of 3% is one of the highest in the world. Over the last 60 years, forest resources in Nicaragua have suffered accelerated deforestation and degradation, losing an annual average of 70,000 hectares. In absolute terms, 50% of the forest coverage has been lost compared to levels in 1948 (40% in the last 40 years). This forces families to set aside more economic resources and productive time to purchase or collect firewood.

Currently, Central American authorities are promoting measures to change habits of timber and firewood use among the population. To that end, Nicaragua has taken the initiative to implement the National Firewood and Charcoal Law. The main organisations promoting the use of improved stoves in the country participated in the design of this legislation.

Asofenix has implemented the improved stove program to promote efficient use of firewood as an energy resource and to improve health and environmental conditions for Nicaraguan households.

2.1. Characterisation of the Program Intervention Area

Asofenix promotes the improved stove program principally in three municipalities of the Department of Boaco in Central Nicaragua: San José de los Remates, Santa Lucia, and Teustepe, where 164 stoves have been built and installed, including Joco-Justa, Emelda, Onil and COCINICA models (see annex 1).

In addition to the 164 IBS installed in the Department of Boaco, the program has also built IBS in the Municipality of Chinandega (22 Lorena and Joco-Justa models), in marginalized neighbourhoods around the capital city of Managua (20 Joco-Justa and M. Benita models), in the City of Ocotal, Nueva Segovia (50 Joco-Justa stoves) and two demonstration stoves in Waspan in the RACN. Asofenix has also trained 25 local outreach promoters and 265 users over the course of the program.

These municipalities present diverse geographic and climate conditions. The first two municipalities are located in the Amerrisque mountain range where the climate is moist to semi-moist, while Teustepe is in a dry tropical savannah. Changes in climate have been reported throughout the region as a result of inadequate management of natural resources.

Map 1
Location of the communities served by the programme

The main economic activities in these municipalities are in the agriculture and livestock sector. The majority of families in the community sell their labour to large plantation owners or dairy farms, or to a lesser extent, cattle-raising for beef production, production of basic grains (corn, beans, or sorghum), citrus fruits, and coffee.

These economic activities generate enormous pressure on soils, forests, and rivers, particularly due to the non-conservationist and expansive production model, which includes intensive use of chemicals and over-exploitation of resources.

In addition to the lack of electricity, the majority of the communities in these municipalities do not have appropriate technology for food preparation. In accordance with studies produced by Asofenix, over 98% of the time families have no other form to prepare hot food besides cooking with an open flame, firewood, and a pot propped on three stones. The firewood comes mainly from the forested mountainsides or private property. Some families have improvised by building

a table with stones, wood, dirt, or cement. In certain cases, families were asked about their knowledge of improved stoves, and they described these as their traditional cooking fires, improved with certain adaptations.

A small workshop was established in 2001 to produce the components of different IBS models, solar kitchens, and biogas stoves adapted to the domestic and productive needs in rural and urban areas.

Asofenix's efforts in these communities has been supported by organisations such as Green Empowerment, ECODES, Hivos, and VibrantVillage. Together, these organisations have funded comprehensive projects for potable water systems with solar energy, including the construction of improved stoves as a health-related component and a contribution toward protecting water sources. Asofenix has also worked together with different organisations in the promotion, construction, installation, and adoption of different models of improved stoves. These collaborations were undertaken with organisations such as RENICC in Chinandega, the Indigenous Government of Waspan, and the COOSEMUDE women's cooperative in Ocotal, Nueva Segovia.

3. Programme Description

3.1. Programme start

Asofenix began its improved stove program in the year 2012, offering different models of stoves to fit the different needs and assure ease of use for the families. The association has designed three models of improved stoves that are adapted to the needs and demands of the users; certain designs of improved stoves from other organisations working in this field were also included in the program. The goal has been to maintain a style and use similar to that of families' traditional cooking fires, based on the use of biomass. This way, families can see the different options on the market and acquire the model that best fits their needs and interests.

These technologies ensure better distribution and use of heat through efficient burning of firewood, using up to 50% less of the energy resource than what is consumed in traditional cook fires, and especially reducing smoke emissions into the home. These stoves are safer and can be built and operated simply.

With this IBS program, in addition to providing different models of stoves according to families' needs and demands, Asofenix also provides training in use and maintenance of these stoves, and raises awareness on the links between IBS, health, and the environment, promoting experience exchange.

Asofenix uses a gender lens to promote equal opportunities for men and women to access and benefit from clean energy sources that can contribute to improving quality of life for individuals, families, and communities. Men and women both participate in training processes to ensure shared knowledge in use and maintenance of improved stoves.

Construction of improved stoves represents an opportunity to generate income for women. Many IBS models have been designed to improve the conditions for small family businesses for women heads of households, particularly restaurants or food preparation.

3.2. Objetives

The program includes the following objectives:

1. To facilitate access to safe and efficient cooking technologies for urban and rural family homes and businesses in Nicaragua.
2. To contribute to reducing illnesses caused by smoke exposure, particularly for women, boys and girls.
3. To contribute to protecting local natural resources.

3.3. Expected outcomes

The three outcomes that the program expects to achieve are:

1. 500 traditional open cooking fires replaced by improved biomass stoves over a three year implementation period, with excellent acceptance and management by the families.
2. 50 promoters and technicians trained, including men and women, in construction, maintenance, and promotion of IBS technologies.
3. Reduction in annual metric tonnes of firewood consumed.

This program is led by Asofenix, a non-governmental organisation that operates using donations and investments to implement projects and offer services for construction, installation, training, and technical assistance. A total of 35,000 dollars have been invested thus far in different components of the program, and half of the total goal of IBS have been built.

4. Programme Implemetation

Based on the IBS models that Asofenix promotes, the implementation process includes the following actions, either performed through its own projects or in collaboration with other organisations.

Preliminary studies

The first actions that Asofenix undertook in the IBS program included prior studies of the areas where the families are located, as well as socioeconomic and firewood consumption studies. This research explored where the families obtain the firewood—if it comes from their property, if it is collected or purchased—if there is high demand (number of sticks per day), consumption in their current stoves (types of traditional cook stoves), cook stove related illnesses reported by families, etc., through a baseline study.

The baseline studies include indicators selected to facilitate follow-up, performance measurement, and project development. The baseline study determines the initial conditions of the stoves, as well as the situation for family health and the environment.

Asofenix is interested in understanding families' habits and customs in terms of their consumption practices, their initial knowledge on IBS, and their interest in Renewable Energy Technologies (RET). This information allows Asofenix to have preliminary data for the implementation of program initiatives. Eventual changes in individual and community life can

then be measured against these data.
The indicators to measure include:

- Number of hours spent cooking
- Frequency for gathering firewood
- Time spent gathering firewood
- Amount of firewood used

The initial studies measure firewood consumption, which helps to determine the reduction in usage of this resource as a result of the IBS.

In qualitative aspects, the studies consider the perceptions of the users on the performance of their cook stoves, the air quality in homes without smoke emissions, and the health impacts of the new stoves. In quantitative terms, the studies measure the number of people that indicate any type of health damage related to smoke inhalation and heat exposure from traditional stoves, as well as data on reduction in firewood consumption.

Mrs. Reina in her traditional kitchen

Upon the conclusion of the project, information will be available to compare the health improvements that users cite, as well as improvements in the economy, environment, and assessment of the IBS.

Family selection

A process is undertaken to evaluate and select the families to ensure successful implementation of the project strategy. Family selection is done by analysing firewood consumption and stove usage habits; for example, examining whether the cook fire is always burning, if large quantities of food are prepared, if the stove is also used to prepare food for sale, or if perhaps the fire is used relatively infrequently because there are few members of the family or they are rarely at home, etc.

Presentation of the project to the community

In addition to these criteria, families' economic conditions and means for income generation are also examined. This assessment includes whether the family has more than one member contributing an income stream, if family income is constant or seasonal, if families depend on paid work from one or two family members, or if household livelihoods depend on agricultural cycles, or even family remittances. These data help to determine whether families will need a greater subsidy to be able to acquire

their stoves, or if they may have sufficient economic capacity to cover the entire cost of the stoves themselves. Based on this information, a payment scale is proposed and adjusted to the economic capacity and characteristics of the families, to facilitate effective access to the stoves.

Capacity-building and awareness raising

These activities are performed at different times over the course of project implementation. The first cycle of training is held prior to construction of the IBS.

Initially, workshops are convened to explain the basic principles of these stove models, and why they are called "improved stoves", as well as their virtues compared to traditional cook fires. During this activity, awareness-raising exercises are conducted around the adoption of this RET as a climate change mitigation response and to improve health. Participants analyse the economic and environmental cost of obtaining firewood. As families learn about the linkages between improved stoves, health, and the environment, and understand how the stoves work and how to take care of them, they begin to analyse their beliefs and behaviour related to the use of traditional stoves and deforestation, and they begin to gain confidence in the efficiency of the IBS.

Later, once construction or installation of the stoves is complete, testing is performed and the families begin to use them. At that time, further training is given to reinforce participants' knowledge and capacities, performing real demonstrations on the recommended usage and maintenance for the stoves.

The capacity-building and awareness-raising process is supported by a very accessible manual for the participants, which contains information on the appropriate procedures to clean and maintain their stoves to make sure that they last. A poster provides further graphic step-by-step information to complement the instructional materials.

Asofenix also trains local outreach promoters in the techniques for proper construction, use, and maintenance of the IBS. The objective of this activity is to build capacities and transfer technologies to organisations and individuals that can disseminate the information and support the proper functioning of the IBS.

Before the trainings are held, the male and female participants are selected based on their interest in learning about this technology, and any prior experience in construction using concrete, which facilitates the learning process. Often there are men with construction experience who need training on the specific techniques in building an IBS. Participants' leadership skills and volunteer work for the community are also considered in the selection process.

As Asofenix initiates contact with the communities, it identifies potential community technicians as well. Often this identification process is simplified thanks to an already established relationship with the communities. This is the case in the municipalities in the Department of Boaco, where projects have already been completed such as water pumps, electrification with solar panels, and micro hydroelectric plants (MHP), among others.

In specific projects carried out in conjunction with other organisations that request collaboration from Asofenix to build the stoves, the organisations themselves are the ones that select the individuals that will serve as technicians or outreach promoters. In these cases, Asofenix provides recommendations for the selection of local outreach promoters who can contribute to ensuring proper use and maintenance of the improved stoves.

Promotion and outreach

The program includes diverse outreach strategies around IBS technologies, including:

Demonstration fairs: The entire community, and even neighbouring communities, can participate in these fairs. Posters are distributed with information on the stoves, and women are able to test them, by cooking traditional dishes. As a result, a large part of the families request and choose the improved stoves that they wish to acquire.

Exchanges among users: Exchanging experiences is a relevant activity in the IBS adoption process. This activity can be done among beneficiaries within a single community, or between different communities. Women who have been in previous projects and have gained experience in using these stoves participate in the exchanges as well. Participants learn together about the benefits of improved stoves. By making food together, the participants transfer knowledge on appropriate stove use, share experiences, and discuss improvements in quality of individual and family life.

The Sonzapote Improved Stove Fair, 2014

Financing model

The financing model is set according to the economic capacity of each family. For example, the total real cost of a Joco-Justa stove, the one most requested by the families, is calculated at USD 210 after the final installation in a home. Generally, families pay the price of the materials and manufacturing, valued at USD 160.00 in Managua. The projects subsidize the costs of transportation, training, awareness-raising, exchanges, and technical assistance.

Some projects subsidize the total cost of the stoves, while in other projects families cover part or all of the cost. A 25% partial payment for the stoves calculates to an average of USD 35.00.

The Asofenix financing model is also based on the agricultural cycle, considering that there are times during the year in which families do not receive any income, and there are times such as

harvest season in which families may be able to make a partial or full payment of the cost of the IBS. There are also cases in which men work abroad and women and children depend on family remittances to pay the cost of the IBS contribution.

The fund received through these partial or total payments for the improved stoves (depending on the organisation facilitating the funds) serves to cover technical assistance, monitoring, and follow-up support for the families after installation (starting at three months, up to one year), as well as to support cases in which certain families do not have the resources to be able to acquire an improved stove.

IBS models

Asofenix offers five models of stoves made from concrete, clay, and metal[1]: ONIL, Joco-Justa, Emelda, M. Benita, and COCINICA. Of these five models, the association builds three itself: Joco-Justa, Emelda and M. Benita. These three models are the ones preferred by families because they are fixed in one place, just like the traditional rural stoves that they are used to. The other two types are built by other organisations, but distributed by Asofenix. Depending on available local materials such as sand and stones, it may be possible to use local resources. All of the materials needed to build the stoves are available in Nicaragua.

The key data for each IBS model are detailed below:

› The ONIL stove is made up of three modular parts. Its load capacity is 12 litres. It uses a chimney of galvanized iron sheeting, and has three rings to aid in installing different sized chimneys. Its combustion chamber is made with a reinforced concrete base and clay bricks, and it uses pumice as a heat insulator. The cost of this stove as distributed by Asofenix is USD 200.00.

› The Joco-Justa stove model is an adaptation by Asofenix of the Justa model designed by the organisation AHDESA in Honduras. The stove works with a combustion chamber to burn firewood efficiently. This model has two wide and removable flat-top grills, allowing users to prepare different types and large quantities of food at the same time. The Joco-Justa comes with a chimney that draws smoke out of the kitchen area. The cost of this stove is USD 160.00.

Nubia López makes tortillas on a Joco-Justa stove.

[1] See Annex 1 Data on improved stove models implemented in the program

› The EMELDA stove has two burners. This model doesn't use a grill or a chimney; it is a simpler structure. This stove has been well-accepted by users who prepare traditional dishes such as soups and nacatamales (prepared with corn, vegetables, and chicken or pork wrapped in plantain leaves and cooked for a long time). The cost of this stove is USD 140.00.

› The M. Benita stove has been designed by Asofenix. It works with a combustion chamber (rocket stove elbow) to burn firewood efficiently and avoid heat loss. This model has a metallic chamber that eliminates polluting smoke and gases and vents them outside the home. It has two burners whose size can be adjusted to the requirements of the families, allowing users to cook two types of food at the same time. The stove is specially designed to meet the needs of businesses that produce large quantities of food and use very large pots. The M. Benita stove costs USD 100.

› The COCINICA model is made in Eastern Nicaragua by a couple from the United States, Nancy and Brian Davis. The COCINICA is a ceramic, cement, and iron cylinder with an opening at the bottom to deposit small bits of firewood or charcoal. Pots can be placed on the upper part. This model is small and lightweight. It does not use a chimney, and it has a 10-litre capacity. The cost of this stove is USD 25.00.

Mrs. M. Benita, using the IBS named after her.

IBS construction

The construction process is divided into two simultaneous phases, and a third phase to conclude the installation of the IBS.

Phase A

A team of technicians from Asofenix is organised with personnel trained in the special construction of the base upon which the IBS sits. Two people from the local area are trained to participate in mass production of the IBS, according to the volume needed for the project.

The association provides instructions for the special construction of the IBS bases, in terms of the dimensions, list of materials, and location.

The technicians work together with at least one member of the beneficiary family as they build their own stove base.

At this point it is critical to be respect the timelines and specifications of these bases, which require three days to dry prior to the installation of the IBS. This phase may take an average of 15 days, depending on the distance to the homes, which may all be gathered near a central point, or up to 30% may be spread further apart.

Mrs. Juana carries the pieces of her stove

Phase B

As the beneficiaries work to build the bases, the metallic assembly pieces and the rest of the IBS components are manufactured in Managua. This phase takes 10 to 20 calendar days, depending on volume (average of 50 stoves).

Phase C

Lastly, the IBS are built, assembled, and finished. If teams work efficiently, they may install two or three stoves per day, depending . This will depend on how well families have taken ownership of the process, and the distance between installation points. This phase takes from 10 to 20 days, varying according to the local conditions.

Stove construction in Sonzapote

Monitoring and follow-up

During the program implementation period in the communities, monitoring and follow-up visits are held with each family. In these visits, the proper operation of the stoves is verified, and visitors observe the use and maintenance of the stoves in families' homes. These visits also reinforce the knowledge and awareness on appropriate stove use, and remind users of the recommendations to avoid certain cooking habits such as excessive use of firewood. Suggestions are also provided on how to prepare more nutritive food and prevent accidents.

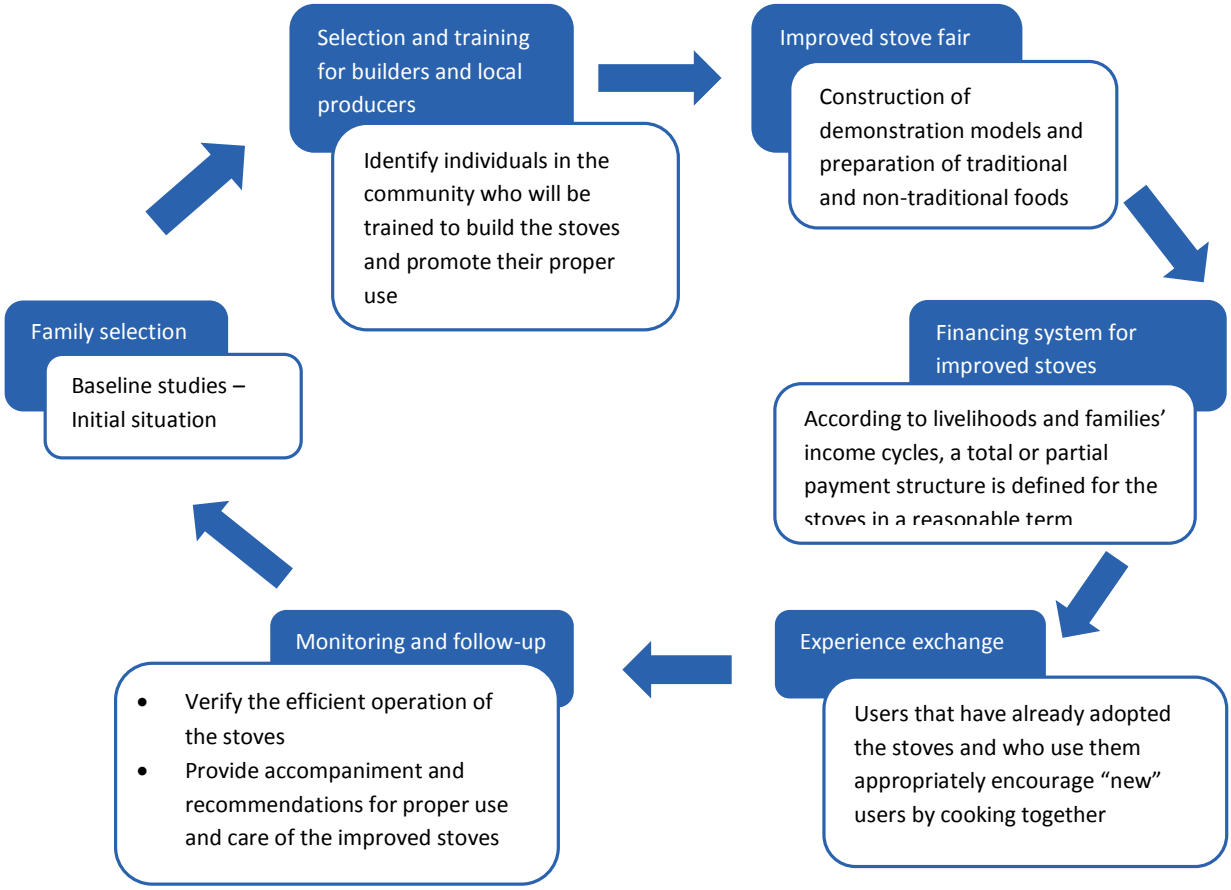
In this stage, data disaggregated by sex are collected on the improvements that each family perceives in health and the household environment. Information is also gathered on who in the family is using and maintaining the IBS.

Asofenix is working to follow up on and evaluate the impacts of the use of improved stoves, comparing the baseline studies to the data collected at the conclusion of the project and for the subsequent few months.

It is important to ensure the necessary economic resources to expand these actions to more communities and over a broader time period. Currently, some projects allow for the provision of technical assistance and follow-up in the three months following the project close, while others consider up to one year.

The data collected in late 2014 in the communities of El Bálsamo and Sonzapote, in the Municipality of Teustepe, reflect that 96% of the 75 families have noted improvements in their health, particularly in respiratory health and eyesight. These improvements were perceived after one year of use of the stoves in the community of El Bálsamo. In the community of Sonzapote, respondents shared these perceptions after six months of using their new stoves.

Programme implementation model



Actions for the protection of natural resources

The Asofenix model includes a component for reforestation, which promotes local information and awareness-raising campaigns, training for families, seed collection, and establishment of nurseries and plantations with fruit and timber species in the communities. In all, 3,000 trees have been planted around areas with natural springs or water sources.

5. Main challenges encountered

Over the years of experience in construction and promotion of IBS in rural areas and in the city, Asofenix has identified the following main challenges:

1. Promoting the use of IBS to replace traditional cook stoves requires capacity-building for user families in new practices of food preparation and firewood use.

2. The use and adaptation of local materials and resources to build the stoves and their bases must be validated to ensure compliance with IBS functionality and efficiency standards.

3. The projects promoted by local organisations to provide IBS require collaboration with the developers to fully consider factors such as: family characteristics, selection, stove models that respond to family needs, training, viability of the use of local materials, design and structure of homes, projected changes in homes, updated costs including transportation, and teaching materials with audio-visual media to promote and demonstrate to families the benefits, uses, and required maintenance for IBS.

4. The bricklayers, local outreach promoters, and supervisors must be trained on the specific techniques needed for construction of the improved stoves.

6. Impactos y resultados obtenidos

6.1. Energy services and quality of life benefits

From 2012 to 2015, Asofenix was able to replace 258 traditional and inefficient cook stoves with IBS through the program, with excellent acceptance by the families.

As the primary users, women report changes in the environment and their kitchens from using stoves free from smoke and soot, and with less heat loss.

Families, and especially women, children, and older adults, began to report better eyesight and health in general.

> *"...We even solved the problem of our household pets climbing into the old cook stoves in search of a little warmth. They can't get into the new stoves, so they don't contaminate anything."*
>
> Women sharing at experience exchange sessions

Time savings have been reported in food preparation and firewood collection. This time is partially dedicated for productive activities of agriculture and project-related actions such as trainings, exchanges between users, etc.

The household economy for these families has benefited from the reduction in expenditures for firewood. The cost of repairing and maintaining homes has also gone down, particularly by avoiding smoke damage to the zinc roofing.

In the communities where Asofenix intervenes with its IBS promotion model, changes are also reported in the natural landscape as a result of the local reforestation activities. Communities have reforested with rapid-growth and spliced trees in priority areas such as riversides, around wells and springs, etc.

The IBS have generated immediate changes in family homes. The main benefits in the short term are perceived as: reduction of cooking time, reduction in firewood used, and reduction of smoke and heat. At the same time, families recognise that their food is better prepared, as their dishes are not burned, they are cooked through uniformly, and not contaminated with kerosene or ash.

Families have also improved their intra-family relations around the operation of the IBS. Family members meet to discuss the new stove and to share as food is prepared and consumed, something that was not possible before with the excessive smoke produced by rudimentary cook stoves.

6.2. Economic empowerment and non-traditional roles

The IBS program has made an impact in economic empowerment and the expression of non-traditional roles around food preparation. Some examples are described below:

Subsequent studies conducted in the communities of El Bálsamo, El Jocote, and Sonzapote, include a survey to examine men's participation in use and maintenance of the IBS. The results show that in men in some cases (20%), including husbands, brothers, or sons, cooked and/or helped with cleaning and maintaining the IBS.

A group of seven women from the communities in the Municipalities of Teustepe and San José de los Remates received scholarships from the National Technical Institute (INATEC). They studied as bakers, and their stoves now allow them to bake for their families and for local sale, turning the stoves into work tools.

Asofenix supported the women's entrepreneurship cooperative in the Department of Nueva Segovia, COOSEMUDE, where 50 Joco-Justa model stoves were built. The women use their stoves to prepare food, corn tortillas, traditional candies, etc. The cooperative facilitated acquisition of the stoves with funds from the United Nations Development Program (UNDP) and each member is making payments toward covering the total cost out of the income from the sale of their products.

6.3. Women's empowerment and participation in decision making

The IBS program has played an important role in terms of promoting women's empowerment and participation in decision-making.

Through promotion and technical assistance for the stoves, the program has encouraged local women leaders to visit and meet with IBS beneficiaries to recommend how to use and adapt their new stoves. These women leaders are constantly motivating families to keep their stoves clean to make sure that they are long-lasting and beneficial to household health and budgets.

Women also are able to decide on the model of the stove they wish to adopt, and the stove fair allows them to consider which stove best fits their needs. While some of the husbands may prefer a different model, women are the ones who choose the stove that they wish to acquire.

> *"I tell the women that they have to get rid of the old cook fire in order to adapt to their new stoves. I review the guides for each model stove, and I explain to them how they need to use it and keep it clean."*
>
> Doña Eusebia Campos, IBS outreach promoter

Users performing IBS maintenance

6.4. Institutional ownership of gender methodology

The Asofenix methodology looks at sustainable use of renewable energies in the communities, in conjunction with equal opportunities. That means that the association seeks to ensure that men and women benefit equally from natural resources and renewable energy to improve their quality of life with mutual respect.

The organisation promotes the IBS program as a benefit that principally helps women in their food preparation tasks, making this activity less harmful to their health and the health of their families. Asofenix also promotes sharing these household roles and tasks among all of the family members. Adult and young men and women should collaborate in cooking and maintaining the improved stove, as well as in other household activities.

Asofenix has identified that the technicians must know how the stoves are used in people's homes, and take these conditions into account in order to build the stove in accordance with family needs and demands, consulting them directly on these topics. The association has also found that the men in households who help to obtain firewood need to know how the new IBS work in order to find smaller pieces that fit in the new chambers.

Asofenix is documenting this experience to design a methodology with a gender lens for all levels of the organisation. This tool will help to measure changes in reducing the gap between men and women in this program and with other renewable energy technologies that the association promotes.

7. Relevance of the experience and lessons learned

7.1. Programme relevance

The IBS program implemented by Asofenix includes certain best practices that make it effective.

The IBS model fair is a way to demonstrate the operation of the different models for families, comparing their advantages over traditional cook stoves.

Experience exchanges familiarise women with the new stoves and help them to learn how to operate the stoves that other women are already comfortable using. Women can also see for themselves the benefits that these technologies bring for them and their families in the short term.

The financing model is adapted to the context and socioeconomic characteristics of the families. This keeps the costs low and facilitates immediate access for families to be able to receive the benefits of an IBS without sacrificing their other basic needs. To do this, the price of the stove that the family chooses, as well as the method and term for payment, must be adjusted to fit their economic capacity. Making payments for the improved stoves should not cripple the household economy.

The IBS promoted by the association are contributing to improve family conditions for food preparation by reducing firewood consumption and diminishing the heat and smoke in the kitchen environment.

In general, families that have an IBS to sell corn tortillas and food report a nearly 50% savings in purchasing firewood. This translates to 40 or 50 córdobas per day, equal to USD 1.50.

The IBS program has impacted a significant number of families and it has the potential to expand, thanks to excellent acceptance and demand from the users and organisations interested in promoting these technologies. The strategies and model implemented by the IBS program have been a key part of achieving and sustaining the outcomes. This model offers elements to consider in public and private national or sector-specific policy and strategies.

7.2. Lessons learned

After three years of experience in construction and promotion of IBS in rural and urban areas, Asofenix has identified the following main lessons:

→ *The use of new stoves requires accompaniment to change certain practices in the use and maintenance of cook stoves.*

For example, in many cases the practice of unnecessarily high firewood consumption persists. There is a habit of constantly feeding the fire. In some cases, women continue to use their open flame cook stoves because they believe that the IBS will not cook large volumes of food or will not withstand the weight of large pots and pans.

→ *The factors that drive families' attachment to the rudimentary stoves should be considered, including their habits, customs, and livelihoods.*

For example: Families tend to accept the traditional cook stoves because they have played a role in other domestic and productive functions such as: drying cheeses, meats, and grains, and repelling flies, mosquitoes, and other insects. Families also used the smoke produced by these stoves as a resource to maintain their seeds for the planting season.

→ *The appropriate operation of a stove requires continual cleaning, something that most families were not accustomed to doing with the traditional stove.*

→ *The technical capacities of the local constructors, promoters, and supervisors must improve, that is, the skills of the actors involved in developing the technology, building the stove bases, and educating the beneficiary families in appropriate use and maintenance.*

→ *The continuity of the studies on the use of IBS after the conclusion of the implementation phase is important in order to understand the medium and long-term impacts on health, the economy, and the environment in the community and surrounding areas.*

→ *In addition to construction and installation of the IBS, the spatial conditions in family kitchens must also be considered.*

The project designs, technicians, and families should consider other environmental factors in the kitchens that need to be improved in order to take full advantage of the benefits of the improved stove and set the conditions to improve food preparation activities overall for the family. Examples include considering lighting, ventilation, construction materials for the kitchen structure, cooking utensils, etc.

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9. Acronyms and abbreviations

AHDESA – Honduran Association for Development (Asociación Hondureña para el Desarrollo)

Asofenix – Association Fenix

COOSEMUDE – Multiple Multiple Service Women's Cooperative for Development (Cooperativa de Servicios Múltiples Mujeres para el Desarrollo)

IADB – Inter-American Development Bank

IBS – Improved Biomass Stoves

ECODES – Ecology and Development Foundation (Fundación Ecología y Desarrollo)

Hivos – Humanist Institute for Development Cooperation

INAFOR – National Forest Institute (Instituto Nacional Forestal).

INATEC – National Technological Institute (Instituto Nacional Tecnológico)

MHP – Mini Hydroelectric Plant

MEM – Ministry of Energy and Mines (Ministerio de Energía y Minas)

MW – Megawatts

NEB – National Energy Balance

NGO – Non-Governmental Organisation

OLADE – Latin American Energy Organisation (Organización Latinoamericana de Energía)

RACN – Northern Caribbean Autonomous Region (Región Autónoma Caribe – Norte)

RENICC – Nicaraguan Network of Community Trade (Red Nicaragüense de Comercio Comunitario)

RET – Renewable Energy Technology

WHO – World Health Organisation

Annex 1

Data on improved stove models implemented in the program

Stove model	Dimensions	Cost*	Manufacturer
ONIL 	127 cm long, 43.18 cm wide, 81.28 cm tall. The metal plate measures 69.31 cm long by 33.75 cm wide.	USD 200.00	Helps International
Joco-Justa 	Stove size: 107 cm x 76 cm x 40 cm Base: 150cm x 100cm x 40cm	USD 160.00	Asofenix
Emelda 	Stove size: 105cm x 56cm x 40cm Base: 120cm x 75cm x 40cm	USD 140.00	Asofenix
MBenita 	Stove size: 36” x 24” x 10” Base: 130cm x 90cm x 60cm	USD 100.00	Asofenix
COCINICA 	30 cm high 25 cm in diameter	USD 25.00	Nancy and Brian Davis

* Unit price in Managua

This publication was produced with the support of: Hivos people unlimited